UNIVERSIDAD DE COSTA RICA
SISTEMA DE ESTUDIOS DE POSGRADO

ENGLISH FOR MECHANICAL ENGINEERING
THE GEARBOX: ENGINEERING YOUR ENGLISH

Trabajo final de investigación aplicada sometido a la consideración de la Comisión del Programa de Estudios de Posgrado en Enseñanza del Inglés como Lengua Extranjera para optar al grado y título de Maestría Profesional en Enseñanza del Inglés como Lengua Extranjera

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Dedicatoria

I would like to dedicate this project to my family, who became part of this and who patiently waited as they supported me during days without sleep, and to God, because His light kept me going so that I did not give up.

Garyan

All the emotional and physical effort that is embedded in this project is dedicated to the one and only, the almighty who kept me going strong despite the hardship and without whom I would have given up long ago. All the blessings that have come and will come out of this are dedicated to GOD.

Laura

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I would like to thank all the people who were with me during this long and enriching journey:

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My dear University, which has given me so much to be where I am now.

Garyan

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Thank you, God, for making all this possible.

Laura

"Este trabajo final de investigación aplicada fue aceptado por la Comisión del Programa de Estudios de Posgrado en Enseñanza del Inglés como Lengua Extranjera de la Universidad de Costa Rica, como requisito parcial para optar al grado y título de Maestría Profesional en Enseñanza del Inglés como Lengua Extranjera."

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Resumen

Las exigencias de nuestro mundo globalizado requieren de profesionales que puedan comunicarse en inglés en materia laboral. Por esa razón, la necesidad de cursos de inglés para fines específicos (ESP por sus siglas en inglés) ha incrementado y Costa Rica no es la excepción. La Universidad de Costa Rica siempre se ha caracterizado por su excelencia en esta área y sus grandes esfuerzos institucionales para proveer a sus estudiantes con las herramientas que necesitan para ser profesionales exitosos. Con este objetivo en mente se realizó la presente investigación en aras de responder a algunas de las necesidades académicas y laborales de 20 estudiantes de ingeniería mecánica de la Universidad de Costa Rica. La primera parte de la investigación presenta el análisis de necesidades y el extensivo proceso de recolección de datos llevados a cabo bajo el método mixto de investigación. A través de estos procesos los estudiantes expresaron sus necesidades, aspiraciones y carencias relacionadas al inglés en su área. Profesores expertos en el área también fueron una fuente importante de información al contribuir en el proceso de recolección de datos con su experiencia en el campo. Este documento también describe en detalle las carencias lingüísticas identificadas a través de la aplicación de un examen de diagnóstico a los estudiantes; y el último capítulo contiene la propuesta diseñada para el curso cuyo propósito es abordar las necesidades, aspiraciones, y carencias de los estudiantes a través de un programa que pretende abarcar algunas de las tareas académicas y profesionales que los estudiantes de ingeniería mecánica realizan o realizarán en inglés. El programa anteriormente mencionado ofrece las herramientas necesarias para alcanzar satisfactoriamente las metas y objetivos establecidos para cada unidad de contenido, y sus bases yacen en mejorar las habilidades de lectura y escritura, seguidas por las de escucha y habla. Las mismas serán abordadas bajo los principios del método basado en tareas (TBLT por sus siglas en inglés).

Palabras clave: Inglés para fines específicos, método basado en tareas, análisis de necesidades, examen de diagnóstico, diseño de programa.

Abstract

The demands of our globalized world require professionals who can communicate in English about work matters. Therefore, the need of courses of English for Specific Purposes (ESP) has increased, and Costa Rica is not the exception. In relation to this, the University of Costa Rica has always been characterized by its excellence in this area, and great efforts are made institutionally to provide students with the tools they need to be successful professionals. This research was developed with this objective in mind in order to address the needs of 20 mechanical engineering students from the University of Costa Rica. The first part of this research presents the needs analysis and extensive data collection process that was carried out under the frame of the mixed methods research approach in which the students expressed their needs, wants and lacks in the use of English in their field. Stakeholders also served as an important source of information by enlightening the data collection process with their expertise on the field. This paper also describes in detail the students' linguistic lacks identified through the application of a diagnostic test. The last chapter of the study deals with the presentation of a course design proposal that aims at addressing those needs, wants, and lacks through a syllabus that intends to guide some of the English academic and professional tasks of mechanical engineering students and professionals. This syllabus offers the tools necessary to fully achieve the goals and objectives established for each unit and has its foundations on the improvement of reading and writing skills, followed by listening and speaking, which will be taught under the principles of Task-Based Language Teaching (TBLT).

Key words: English for Specific Purposes, Task-Based Language Teaching, needs analysis, diagnostic test, syllabus design.

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ASME:

CAD: Computer Aided Design

EAP: English for Academic Purposes

ESP: English for Specific Purposes

EFL: English as a Foreign Language

EOP: English for Occupational Purposes

ESL: English as a Second Language

ETS: English Testing Services

MMR: Mixed Methods Research

TOEFL: Test of English as a Foreign Language

TOEIC: Test of English for International Communication

UCR: Universidad de Costa Rica

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Chapter I: Needs Analysis

The field of English language teaching has undergone several developments over the years in order to adapt to the fast-changing world. New research studies have provided fresher views on the role of teaching and learning in society, and on the interests and needs of learners. English has also established itself as the language for work; and therefore, a more specialized, technical use of the language has become a necessity for employers and employees to perform to the standards or large and small organizations. The University of Costa Rica (UCR) contributes to society with the academic preparation of English Teaching professionals who can address the needs of the labor force and employers, specifically with the English for Specific Purposes (ESP) course that all students of the Master's Program in Teaching English as a Foreign Language have to develop and implement as part of their graduation requirements. The benefits of the design and implementation of this ESP course extend to UCR students of other majors who are chosen as the target population of the course and are therefore provided with language tools that boost their job opportunities.

The success of the ESP syllabus and program to be designed is inherently bound to a robust needs analysis that, if carried out effectively, is going to define the path through which teaching, assessment, and materials design will be directed. The needs analysis process provides the necessary data in regard to the needs and wants of the potential students of the ESP course and, therefore, paves the way for the syllabus, the lesson plan, assessment design, and assessment development. On this respect, Dudley-Evans and St. John (1998) claim that "the key stages in ESP are needs analysis, course and syllabus design, materials selection and production, teaching and learning, and evaluation" (p. 121). They define needs analysis as "the process of establishing the 'what' and the 'how' of a course" (p. 121) and explain that needs analysis in ESP encompasses determining target situation analysis, wants, present situation analysis, lacks, and learning needs (p. 125). Paltridge and Starfield (2013) define needs as

> an umbrella term that embraces many aspects, incorporating learners' goals and backgrounds, their language proficiencies, their reasons for taking the course, their teaching and learning preferences, and the situations they will need to communicate in. Needs can involve what learners know, don't know or want to know, and can be collected and analyzed in a variety of ways. (p. 325)

Moreover, the wants or subjective needs, as defined by Dudley-Evans and St John (1998), are the personal information about the learners, "the factors which may affect the way they learn such as previous learning experiences, cultural information, reasons for attending the course and expectations of it, [as well as] attitude to English", whereas the lacks are described as the "gap between the needs and the wants" (p. 125). A similar view is proposed by Robinson (1991), who contrasts objective needs and subjective needs or wants. He states that the first term "refers to needs which are derivable from different kinds of factual information about the learners, their use of language in real-life communication situations as well as their current language proficiency and language difficulties" (p. 8). The author also states that the second term "refers to the cognitive and affective needs of the learner. . . derivable from information about affective and cognitive factors such as personality, confidence, attitudes, learners' wants and expectations with regard to the learning of English" (p. 8). Altogether, the information about learners' wants and lacks makes a relevant contribution to the design of an ESP course for a specific population.

As part of the master's graduation requirements, the student-teachers were assigned the target population of mechanical engineering students for the course design and the practicum project. The use of English in the field of mechanical engineering is greatly relevant for students in the major and for engineers at work, as evidenced in the large number of English interactions in which mechanical engineers are expected to satisfactorily perform in several written and spoken tasks. The strong presence of multinational companies in Costa Rica that require bilingual engineers, and the considerable amount of material that engineers have to use in English, makes this language an essential qualification for mechanical engineers.

The purpose of this study is to address the linguistic needs, wants, and lacks of a group of mechanical engineering students at the University of Costa Rica through the development of an ESP course tailored to their needs and aiming at addressing the most relevant skills and contents within a specified time frame.

Description of the Participants' Field of Work and Tasks

Mechanical engineering is "a branch of engineering concerned primarily with the industrial application of mechanics and with the production of tools, machinery, and their products" (Merriam-Webster, 2019). Narrowing down to a more specific definition, Michigan Technological University explains that "mechanical engineering is the application of the principles and problem-solving techniques of engineering from design to manufacturing to the marketplace for any object" (Michigan Tech, 2019). This university claims that mechanical engineers make a difference in their field because their focus relies on the creation of technologies to meet the needs of humans. In addition, Ibbotson (2008) explains that mechanical engineering involves the design and production of machines like engines, pumps, vehicle chassis, and automated production lines. According to Columbia University (n.d.), mechanical engineers "learn about materials, solid and fluid mechanics, thermodynamics, heat transfer, control, instrumentation, design, and manufacturing to understand mechanical systems". Thus, as evidenced, mechanical engineers need to reach a very high degree of expertise in a variety of areas that come together to sustain the foundations of their work. The Michigan Technological University also addresses the fact that experts in the area carry out analyses of their work aiming at competitive costs by relying on the principles of motion, energy, and force.

Mechanical engineers oversee a variety of tasks. Michigan Technological University sums up their job by explaining that mechanical engineers combine their creativity, analytical tools, and knowledge to bring their ideas to reality. They can impact humankind at a personal, local, and nationwide scale ranging from the designing of robotic prostheses to advanced power systems. In addition, they mention that mechanical engineering includes work on disciplines such as acoustics, aerospace, automation, automotive, autonomous systems, biotechnology, composites, Computer Aided Design (CAD), control systems, cyber security, design, energy, ergonomics, human health, manufacturing and additive manufacturing, mechanics, nanotechnology, production planning, robotics, and structural analysis, among others (Michigan Tech, 2019). This branch of engineering involves several areas and offers experts in this field the possibility of developing in a variety of functions. The American Society of Mechanical Engineers (ASME) currently lists 36 technical divisions ranging from advanced energy systems and aerospace engineering to solid-waste engineering and textile engineering; these divisions can branch out into a wide variety of tasks (ASME, 2018). The Michigan Technological University lists in its website some of the tasks mechanical engineers can perform, which contemplate conceptual design, analysis, presentations, report writing, project management, testing, data interpretation, prototyping, sales and consulting (Michigan Tech, 2019). Thus, it is evidenced that mechanical engineers have a wide area of work and that tasks have to be carefully completed due to their impact in human lives.

Methodology

Approach

The approach to this research study is the mixed methods research approach (MMR), which combines quantitative and qualitative methods. Brown (2015) defines this approach in three different ways depending on which kind of research dominates:

> Qualitative mixed research includes both qualitative and quantitative research methods combined with the qualitative ones dominating, while quantitative mixed research also includes both qualitative and quantitative methods combined, but with the quantitative ones dominating. And, pure mixed research combines quantitative and qualitative methods but with both having equal and balance standing. (p. 78)

The benefits of using the MMR approach lie in the fact that “researchers who want to apply MMR need to plan and carry out their investigation with the goal of enhancing the mixed nature of the study and defending the quality and value of mixing both methods” (Brown, 2015, p. 79). Examples of qualitative data that were used in this study are the questionnaires with questions in which participants were asked to provide information on their interests, wants, and preferences for the development of the syllabus and the whole course, as well as to understand the field of mechanical engineering. This research also included audio-recorded interviews with stakeholders to analyze real samples of language use, one-on-one interviews with participant students to better comprehend the participants’ motivations and perceptions towards the ESP course, and categorization of the data collected in open-ended questions in student and stakeholders’ questionnaires. This was done in order to obtain further details on duties they perform as engineers and regarding their needs and wants. In addition to this, there was collection and analysis of real language samples and authentic materials used by mechanical engineering students and professionals. These were provided by stakeholders, participants, and unstructured interviews. As for quantitative data, in this study multiple choice and rating scale questions were used for demographic data collection as well as a diagnostic test that provided grading and performance ranges. Other questions in questionnaires gathered data in numerical form and generated graphs and tables based on categories and ranks.

Context

The research developed was conducted with mechanical engineering students attending their graduate program on the main campus of the University of Costa Rica in the year 2019.

Participants

An initial questionnaire was shared with mechanical engineering students who signed up at their school, and 95 responses were received. In order to filter the large number of participants and reduce it to a much more manageable group highly committed to the course process, a second questionnaire was shared and 44 responses were obtained. During the follow up interviews for additional data collection, the final number of participants came down to 25, with 21 being between 17-25 years old, and only 4 between 26 -35 years old. Out of the 25 participants, only three are currently working in different fields, positions, and companies. The data collected shows that 100% of the participants are mechanical engineering students who are distributed along the different years of the program in the following way: one participant is in first year, five are in second year, six in third year, nine in fourth year, and four in the fifth year of the major. In relation to the participants' previous background with English, three have never studied the language; out of the other 88% who have studied English before, four have studied English for a year or less, five for two years, two for three years, two for four years, and nine for five years. This means that the group has had varied exposure to the language and therefore some adjustments need to be made in the course.

Instruments used for data collection

Different instruments were applied in order to collect data, including three questionnaires for participants with different sections to be completed (see appendixes A, B, and C). The information included in the items about specific engineering tasks was derived from informal collection of data and real samples from mechanical engineers that are not part of this study, as well as from research done about the tasks mechanical engineers have to carry out in English at work. Since “it is likely that the questionnaire will seek information for both target situation analysis and present situation analysis” (Robinson, 1991, p. 12), the questionnaires gathered information about participants’ experience with the language, English use at work and during their program, expectations for the ESP course, preferences for classroom activities, and demographic information. There was also a set of questions to better comprehend other needs and wants. An unstructured interview was also conducted with participants as a follow-up to some of their responses to the questionnaires (see appendix D). In this interview participants had the opportunity to elaborate on their answers concerning their needs, wants, lacks, and perceived proficiency, as well as what they consider their biggest challenges.

Another instrument that was developed consisted of a questionnaire for stakeholders (see appendix E), which was complemented with a semi-structured interview (see appendix F). This interview highly contributed to enriching the researchers’ knowledge about the tasks that students and employees in the field of mechanical engineering are expected to perform in English. Finally, a diagnostic test (see appendix G) was created in order to collect data on the students' level of English, in addition to lacks and gaps that needed to be bridged through the development of the course.

Procedures

Six mechanical engineering professors from UCR provided data through an electronic questionnaire. Additionally, one unstructured, face to face interview with a stakeholder was carried out and audio recorded with the corresponding permission at the main campus of the University of Costa Rica for thirty-five minutes with one of these professors. Moreover, the interviews with student participants were conducted electronically and took approximately 15 minutes to be completed depending on the extension of the participants' answers. All questionnaires (to stakeholders and student participants) were shared electronically through Google Forms. The estimated time to complete the questionnaires was thirty minutes, but it varied depending on how much participants elaborated on the open-ended questions in the survey. Finally, the time allotted for the diagnostic test was 70 minutes.

Results and Discussion

Interests of Primary Stakeholders

Six professors from the mechanical engineering program at the University of Costa Rica were surveyed through Google Forms, and they provided data about tasks mechanical engineers carry out in English as part of the major and as professionals. All six of them agreed that reading is the most necessary skill for mechanical engineering students while at college, but the scenario is different for mechanical engineers who are already working, according to these professors. When asked about the frequency with which each macro skill is used by mechanical engineers at work, 4 out of the six surveyed professors rated speaking, reading, and listening as very frequently used. Moreover, writing was marked as very frequently used by 3 of them. These answers reveal that according to the surveyed stakeholders, the frequency of exposure mechanical engineers have to each macro skill is different depending on the context. Reading is more frequently used at college whereas speaking, reading and listening are equally frequent in the workplace. This is a crucial consideration for the development of the ESP course since it enlightens the focus that the course should have on each macro skill depending on the profile of the students.

Stakeholders were also asked to choose the tasks for each of the four macro skills that they considered necessary to be included in the course. In the case of writing, email writing was the only task that was chosen by all 6 respondents, followed by summary writing which was chosen by 5 respondents. As for reading and speaking, there were no tasks chosen by all 6 professors but there were two tasks for each skill that were chosen by 5 of them: reading manuals, reading articles, explaining procedures, and describing processes. Finally, when asked about listening tasks that the course should include, 5 respondents chose listening to conferences and 4 of them chose listening to instructions.

The questionnaire for stakeholders also inquired about tasks that mechanical engineers do at work and that were not included in the options previously chosen. Stakeholders believe students must develop call conferencing skills for when they need to speak with technical support representatives, trainers, or bosses in non-Spanish speaking countries. In addition, the topics that stakeholders indicated to be more relevant and should be taught in a course for mechanical engineers are related to procedures, standards, regulations, and new technologies.

Concerning stakeholders' wants for the ESP course, they mentioned tasks such as technical article writing, conversation skills, simulations, digital models, and learning technical vocabulary. In terms of frequency of integration of macro skills in the course, they want reading to always be included, listening and speaking to be very frequently included, and writing to be often included. (see Figure 1).

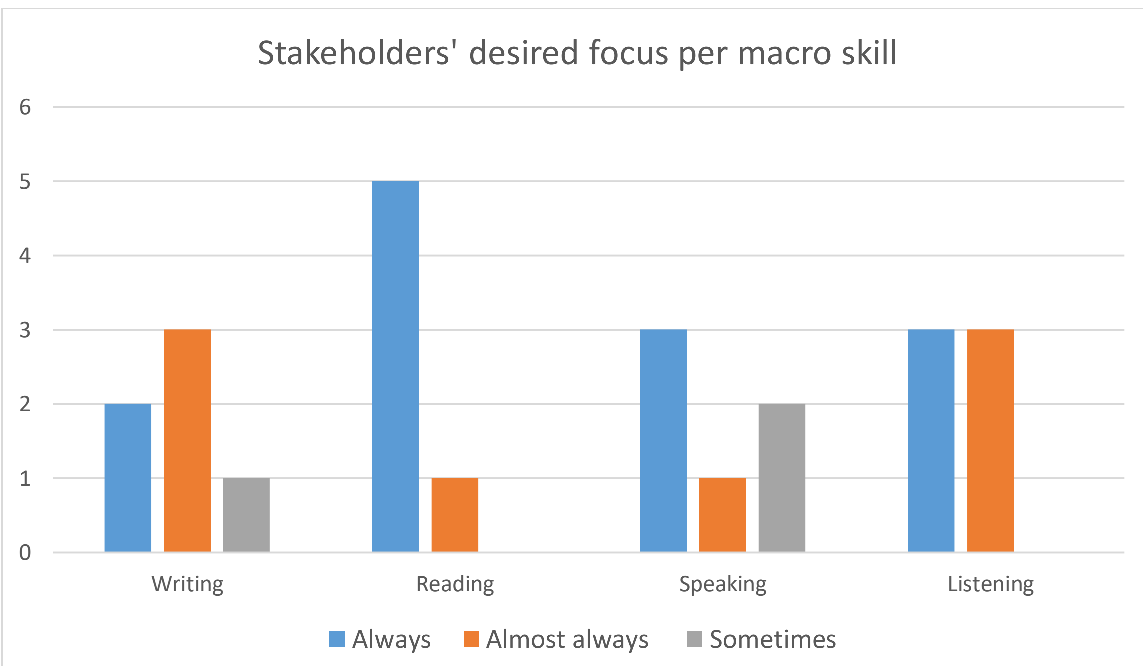

Figure 1. Stakeholders' ranking of how much emphasis each skill should receive in the ESP course. This figure represents question 1 from part IV of the stakeholder's questionnaire.

Positions the Participants Have or May Have at Work

The great majority of the participants are still students and have no work experience in the field of mechanical engineering. Only 12 % of the respondents have worked before, represented by only 3 out of the 25 participants. These three students work as a manufacturing engineer, a designer of mechanical systems in the construction field, and as a mechanical facilities budget analyst. The other 88% of the participants are students majoring in mechanical engineering. Once they graduate, mechanical engineers can work in a wide variety of trainee, junior, lead, senior, coordinator, or managerial positions of the following careers: architectural and engineering manager, software engineer, mechanical engineering technician, nuclear engineer, petroleum engineer, sales engineer, physicist and astronomer, project engineer, design engineer, manufacturing engineer, development engineer, industrial engineer, quality engineer, electro mechanical engineer, process engineers, tool design engineer, manufacturing engineer, development engineer and construction engineer among others. This is according to the American Society of Mechanical Engineers (ASME, 2018), the students and stakeholders' questionnaire, and Michigan Technological University (Michigan Tech, 2019).

Description of the needs

Mechanical engineers need to carry out several academic and job-related tasks in English, and the higher the job position they aspire to have, the higher the level of English required by employers as mentioned by stakeholders and students' interviews. Participants were asked to indicate the frequency range with which several tasks are done in the academic and work setting. According to professors and the majority of student participants of this study, most of the academic written tasks and all oral academic tasks mechanical engineering students carry out are in Spanish. The only written task that is carried out in English according to 48% of the respondents is taking notes in class when exposed to any material in English, and with low frequency. The academic tasks that students carry out in English with medium frequency are limited to reading and listening. They sometimes read norms and regulations, scientific articles, newspaper articles, manuals, and theoretical or technical books, and they sometimes listen to expert conferences and explanations or descriptions of processes and procedures.

In the high frequency range, reading scientific articles was selected by 32%, and it is the task with the highest percentage in this frequency range. It is followed by reading specialized magazines, reading manuals, and reading theoretical books which received only 20%. There are no tasks reported for the very high frequency range to be carried out in English in their program, but the scenario is different for mechanical engineers in the workplace. Stakeholders were the main source of information about tasks that mechanical engineers do at work in English since the vast majority of the student participants have no work experience yet.

Speaking to coworkers in English was indicated as a very low frequency task (unless working in a foreign country or a multinational company) because as explained by stakeholders, most interactions in English happen with medium frequency between mechanical engineers and clients and/or supervisors. Medium frequency was likewise pinpointed by stakeholders for writing emails to coworkers, writing procedures and descriptions of products, listening to conferences, describing processes, explaining procedures, and explaining technical functions. In addition, a high frequency was suggested for other tasks. This is the case of writing reports, writing emails to supervisors and bosses, reading books, plans and emails, listening to descriptions and explanations of procedures and requirements, speaking to bosses and supervisors, and discussing technical processes. Finally, reading manuals, newspaper and magazine articles about mechanical engineering, and reading scientific articles were allocated in the high frequency rate for tasks performed in English in the workplace.

The questionnaire also asked student participants about the different audiences they are likely to interact with and they were provided with the names of five tasks and four possible audiences including other engineers, clients, the public in general, and others. The first task referred to explaining how a machine works, while the second task corresponded to explaining the assembly of a machine. The third task that participants were presented with was writing emails, and finally the other two tasks dealt with the description of regulations and procedures. The results are illustrated in table 1.

Table 1

Audiences that participants are likely to interact with when performing specific tasks.

Tasks	Other engineers	Clients	General people	Others
Explain how a machine works	24%	28%	44%	4%
Explain how to assemble a machine	48%	12%	32%	8%
Write emails	24%	24%	48%	4%
Describe regulations	24%	48%	20%	8%
Describe procedures	32%	36%	20%	12%

All of the above results are summarized (See appendix H) and offered practical data to derive two main conclusions about the participants' needs. First, these needs are represented by those tasks that mechanical engineering students and professionals do always or very often. Second, these are the same tasks that should shape the course objectives, materials, and assessment tools.

Depending on the context or organization where mechanical engineers work, their English level could determine their suitability for travel or training opportunities, job promotions, as well as the timely completion of processes; that is according to stakeholders' answers. Most of the materials such as articles, manuals, norms, and standards, are mainly found in English (See appendix I), and several mechanical engineering tasks depend on these documents. Consequently, the better the level of English, the better the task performance. As stated by stakeholders, faulty performance could cause problems with customer satisfaction due to slow processes, costly delays, acquisition of wrong equipment, machines and software, loss of customer credibility, exclusion of members from a project team, and in the worst case scenario, human lives can be put at risk.

In the academic context, students are exposed to written and oral texts in Spanish as part of their major. However, participants of the study indicated that a great deal of books, articles, graphs, norms, standards, and manuals are written and easily found in English. Those students with some English knowledge are able to easily leave behind those who do not understand the language by having a greater exposure to content in English and a better grasp of it. The same happens with conferences and congresses, which are mainly in English, and therefore those who can understand the language reportedly have better opportunities of training and academic growth.

Description of the wants

Participants were asked to rank the focal time that they want the ESP course to devote to each of the four macro skills (see figure 2). Speaking is the skill that participants would like to practice more frequently in class, whereas reading is the least desired skill. Participants were also surveyed for the tasks for each macro skill they want the course to emphasize. Writing emails to clients and writing descriptions of procedures were chosen by 80% of the participants each in the case of writing, followed by writing emails to experts and supervisors which was chosen by 72% of the participants.

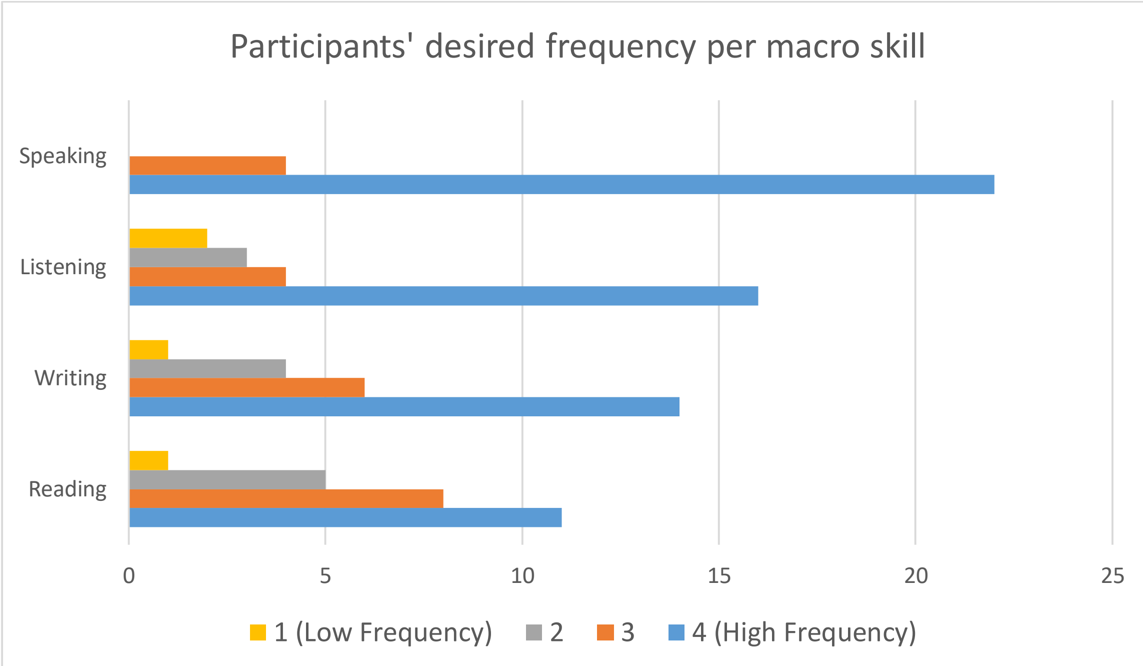

Figure 2. Students' ranking of how much emphasis they want each macro skill to receive in the ESP course. This figure represents question A from part V of student questionnaire A.

Along with writing, listening is in the middle of the spectrum of desired frequency focus according to participants. For this skill, the two tasks with the highest percentages are listening to expert conferences (92%) and listening to explanations given by experts on specific technical topics, chosen by 100% of the participants. Even though reading was the macro skill that participants want to be the least exposed to in class, there were four reading tasks that received high percentages when participants were asked which reading tasks they would like to carry out in class. Reading books about technical concepts was chosen by 96% of the surveyees, reading scientific articles and reading manuals by 80%, and reading emails from customers and experts by 72 %. It seems that despite the fact that reading is not highly desirable for the participants, they recognize that the skill is key to perform integrally in the workplace, which conflicts with their needs and wants for reading.

For the most wanted skill, speaking, the tasks with the highest percentages are describing how a product works and describing technical procedures, which received 24 counts each out of the 25 participants, representing 96%. Furthermore, discussing procedures for the production of different products was upvoted by 21 students, meaning 84% of them. These results for speaking tasks showed an alignment with the results of the skill itself since both areas projected the highest percentages. Finally for the wants, the topics that most participants wanted to see as part of the English course are project design, standards and norms, thermodynamics, tools, machine parts and elements, aerospace, aeronautics, automation, pipeline design, and new technologies.

Description of the lacks

Students indicated to have studied English at school; however, they remarked that classes lacked practice or reinforcement of specific contents which prevented them from acquiring a higher English level. Most students reported to have improved their English level by playing video games and taking additional English courses after high school. Most of them also expressed a self-perception as intermediates (see Figure 3). Although a large percentage of students perceived themselves as intermediates, they reported to struggle when performing tasks such as explaining procedures and describing orally how a product works, discussing different ways to carry out a process, asking questions to experts, writing descriptions, explaining in a written form how a process works, and writing lab reports and writing emails to experts and supervisors. Neil Anderson (personal communication, April 24, 2019) considers finding out the learners' perceived level of proficiency important for a window into their awareness, monitoring skills, and degree of success as English learners.

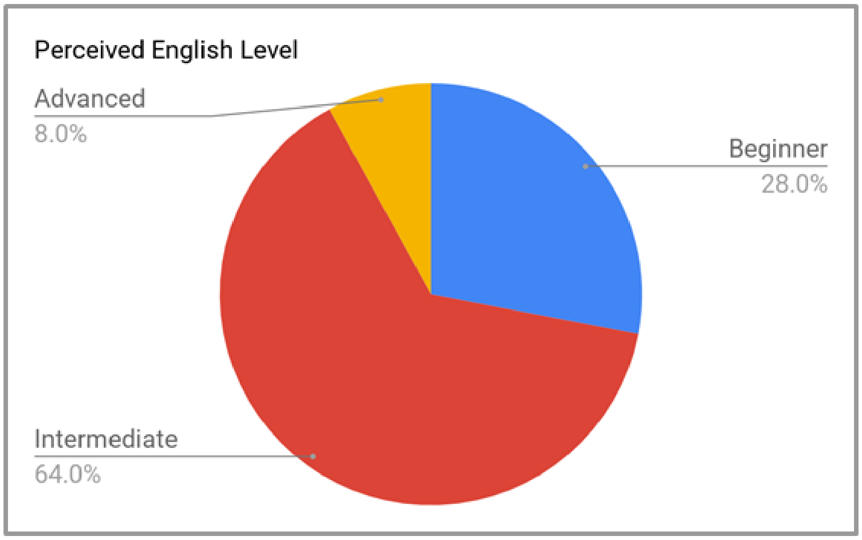

Figure 3. Students' perception of their English level. This figure represents question 2 from Part II of student´s questionnaire A.

The following section presents the rationale, description, and results of the diagnostic test as well as their implications.

Diagnostic Test

The purpose of this section is to present the rationale and results of the diagnostic test in order to accurately identify the students' strengths and especially the weaknesses concerning their ESP needs and lacks in their particular academic and/or job context. In the first place, it is necessary to start by defining what a diagnostic test is. Harris and McCann (1994) explain that unlike other tests which are "based on success, diagnostic tests are based on failure" (p. 29). Coombe, Folse, and Hubley claim a similar view by stating that "a diagnostic test identifies areas of weakness which need to be reinforced or taught in a given course" (2010), or as put by Brown (2004), “such tests [diagnostic tests] offer a checklist of features for the administrator (often the teacher) to use in pinpointing difficulties” (p. 47). These identified difficulties should mark the path for syllabus design since “diagnostic tests should elicit information on what students need to work on in the future” (Brown, 2004, p. 47).

Test Administration

The diagnostic test (See appendix G) was administered at the School of Mechanical Engineering at UCR’s main campus on April 30th, 2019 by the two researchers of this study. Due to students’ availability for taking the test, two different sessions were scheduled on the same day at different times to have more attendance. Eight students took the test at 8:00 a.m. and twelve other students at 9:00 a.m., and all of them completed the entire test during the session they attended. The time allotted for the test was 70 minutes for the written part and approximately 10 minutes for the individual oral test. The total attendance was 20 students out of the 25 who had been invited, and all students completed both the written and oral parts of the diagnostic test. The order of the administration for each section was reading and writing for the first block, listening for the second, and speaking at the end. Reading and writing were placed first in the test since this section required more concentration and thinking demand on the students’ part, so we wanted to prevent wrong answers due to tiredness (Brown, 2004). Another reason to place the reading and writing block before the listening section was so that potential late arrivals did not interfere with the listening, and the speaking section was left at the end for administration logistics purposes. For the oral section, each student was assessed by two administrators simultaneously while also being recorded in order for a third rater to grade each of the students afterwards. This ensured triangulation and provided transparency to the process (Green, 2014).

Assessment Principles

Practicality. Brown (2004) defines practical tests as tests that have a reasonable cost, take an adequate amount of time for their completion, involve easy administration, and provide easy marking and grading (p. 19). Green (2014) suggests viewing practicality in terms of efficiency: “the extent to which the commitment to a system of assessment is justified by the benefits it brings” (p. 60). These implications applied to both the written and oral sections of the diagnostic test in this research, and therefore practicality was met. The reproduction and photocopying of the test was not expensive, the time allocation was proper for the all of the tasks to be completed at ease, administration procedures were correct and simple, and the marking was effortless and efficient. The oral section of the test was even more inexpensive than the written one since all the necessary materials for the administration of this section were a set of student cards which contained specific, student-friendly instructions and which was reused every time a student was assessed as well as a set of cards for each of the two administrators. Specific instructions were also provided to administrators for them to know when to move on to a second oral task depending on students’ performance and proficiency level; thus, all of this made the test administration a simple and practical process. The creation of a carefully revised answer key provided efficiency to each rater in the process of marking the written section, while carefully developed rubrics served the same purpose for the oral section.

Validity. As clearly defined by Gronlund (1998), validity is “the extent to which inferences made from assessment results are appropriate, meaningful, and useful in terms of the purpose of the assessment” (p. 226). Both Brown (2004) and Green (2014) agree with the importance that the principle of validity brings to a test, but the latter provides an in-depth definition of validity. He states that “validity is not thought of as a quality of assessments at all, but is a quality of the *interpretations* that users make of assessment results: an assessment can only be considered valid for a certain purpose” (p. 75).

Even though Brown (2004) claims that there is no definite measure of validity, he argues that test validity can be supported by invoking different types of evidence such as content-related, criterion-related, and construct-related evidence, as well as consequential and face validity. Below, we will look at how different types of evidence were present in the diagnostic test developed for the purpose of this study.

Content validity was met because all of the tasks designed for the test represented actual tasks that mechanical engineers have to carry out during the major and mostly at work, which is where the highest demand of English is present. As stated by Green (2014), “the material included in the assessment should represent the full range of knowledge, skills or abilities that the assessment is intended to cover” (p. 78). In other words, “[if the test] requires the test-taker to perform the behavior that is being measured, it can claim. . . content validity”

(Brown, 2004, p. 22). The tasks students had to perform in the test were created based on the data collected through the needs analysis, specifically from the students and stakeholders' wants, needs, and lacks. Real samples of materials, texts, and documents mechanical engineers use in English were also analyzed prior to the diagnostic test construction as a way of reassuring that content validity was met.

Validity of the results was also achieved through a grading system focused only on the requirements of each of the tasks. To illustrate, in the writing task in which the students were asked to write an email reply, they were only graded on the requirements of the task like completion, use of vocabulary, and organization among others, but they were not penalized for the specific choice of tool or the recommendations they gave the customer who wrote the prompt email. A similar focus of grading was used for the listening section, in which students were given the points for each correct word in the cloze passage even if the word contained a minor spelling mistake. This grading was done in this fashion since the aim of the task was to understand and write the correct word.

Another type of evidence of validity that was met in the test is face validity. In the words of Brown (2004), face validity "means that the students perceive the test to be valid" (p. 27), and this feature was achieved through the encounter of several characteristics in the test that create in the students a perspective of a well-designed test. This was evidenced in the diagnostic test through the following: a) the construction of tasks students are familiar with in engineering and that have the expected format for that type of task, b) the logical and organized structure of the test, c) appropriate timing that allowed students to complete the test within the allotted time, d) the clarity of instructions, and finally, e) the authenticity of the tasks, which leads to another principle of language assessment. Green (2014) explains that “if the steps that the assessee has to go through to obtain a high score on the test closely match the process that language users go through when carrying out tasks in real life, the assessment accurately represents relevant features of the assessee’s knowledge, skills or abilities and so must be valid” (p. 75). In a similar view, Brown (2004) defines authenticity as a major principle of language testing and suggests that claiming authenticity in a test means that tasks are presumably to be carried out in real life. In the reading section of the diagnostic test, students worked with a manual and an email which were provided by mechanical engineers as real samples used at work, as well as an abstract of an article used by mechanical engineering students in the major. The same happened for the listening section where tasks involved listening to real, authentic content spoken by experts in the field.

Reliability. The diagnostic test was consistent and dependable because the principle of reliability was addressed through student-related reliability, rater reliability, test administration reliability, and test reliability. The administration of the test took place in a room with all the appropriate furniture, audio, lighting, temperature, and low noise conditions. All the material used for the test was clear due to quality photocopying, and there were two administrators at all times. Items were carefully designed and revised before implementation to make sure that there were objective scoring procedures and to eliminate potential issues related to ambiguity, double-barreled questions, or any other confusions because of poor item construction or test formatting. The test’s reliability and administration reliability conditions, along with the inclusion of familiar tasks, led to student-related reliability by reducing anxiety, stress, or any other psychological factors that could affect test scores (Brown, 2004). Finally, administrators and researchers of this study also met rater reliability thanks to grading and scoring strategies that were implemented. Clear criteria and rubrics were used for both productive skills, and an answer key was the guide for checking receptive skills items. The tests were marked by two different test administrators on different days in order to avoid fatigue and biased scoring, and oral test recordings were listened to several times by the two researchers before scoring them. The scores assigned to each student by each administrator were compared and averaged as Brown (2004) and Green (2014), among others, suggest.

Skills Addressed in Each Section

The diagnostic test designed for mechanical engineers at the University of Costa Rica was divided into three major sections. The sections were distributed by taking into consideration what students expressed to be their major needs; thus, the first section contemplated reading and writing. In this case, the reading section had students implement micro skills such as developing and using “a battery of reading strategies such as scanning and skimming, detecting discourse markers. . . and activating schemata for the interpretation of texts” (Brown, 2001, p. 307). The reading activities were also structured so that they represented a significant amount of challenge by having students “infer context that is not explicit by using their background knowledge and infer links and connections between events, ideas, and deduce causes and effects" (Brown, 2001, p. 307). On the other hand, in this first section the area of writing addressed micro skills which according to Brown (2001), include the use of acceptable grammatical systems, expressing a particular meaning in different grammatical forms, using cohesive devices in written discourse, and appropriately accomplishing the communicative functions of written texts according to form and purpose (p. 343).

The second section addressed the area of listening. This one encouraged the implementation of micro skills which Brown (2001) names as retaining chunks of language in short-term memory, processing speech at different rates of delivery, recognizing that a particular meaning may be expressed in different grammatical forms, and distinguishing between literal and implied meaning (p. 256). Finally, the last section of the test consisted of speaking, which mainly had them "accomplish appropriately communicative functions according to situations, participants and goals" (Brown, 2001, p. 272). This came along with the Common European Framework (CERF) parameters for spoken production, which contemplate expressing complex ideas at ease by including a variety of structures, easily switching from one tense to another, using precise vocabulary in explanations that are detailed and clear, and of course applying the appropriate pronunciation and intonation patterns in fluent speech (CEFR, n.d.). Brown (2001) also points out micro skills that were paid attention to when students were performing, including the production of "English stress patterns", using "an adequate number of lexical units to accomplish pragmatic purposes", "monitoring oral production", using "grammatical word classes (nouns, verbs, etc.), systems (e.g., tense, agreement, pluralization), appropriate word order, patterns [and] rules", "expressing a particular meaning in different grammatical forms", and "using cohesive devices in spoken discourse" (p. 272). All of what has been pointed out in this section will be elaborated in more detail in the following section of this paper.

Macro and Micro Skills Selected

After carrying out the first part of the needs analysis in which participants and stakeholders provided us with their valuable input related to the needs of a course for mechanical engineers, the foundations and rationale for the design of a diagnostic test started to be shaped in the light of these results. To briefly refer to this and visualize the skills addressed in each section of the test in a top-down perspective, it is relevant to mention that both parts, stakeholders and participants, indicated that the course needs to include the four macro skills but with a greater focus on reading, followed by writing, listening, and speaking. Thus, this is the exact way the test was designed by assigning a heavier weight of points to reading and then to the other skills mentioned accordingly. Moving on from the needs to the wants, speaking was highly expected to be worked on as part of the wants of the participants, including the fact that knowing about their oral production was key to evaluate their current performance in this area and obtain a clearer picture of where students are in general terms.

Writing. According to Coombe, Folse, and Hubley, "assessing writing skills is important because good writing ability is highly sought by higher education institutions and employers" (2007, p. 70). Both stakeholders and students selected writing as the second most important skill for students and workers in the mechanical engineering field, which matches the authors' position about the role of writing. As a result, two different writing tasks were included in the diagnostic test. The first one consisted of a base prompt task, which is a task where students have to respond to a stimulus based on a direct and simple prompt (Coombe, Folse, & Hubley, 2007). The task included a set of pictures of specific tools and students needed to choose one to describe it including at least the three requested elements. The aim of the task was to determine students' ability to write a description and to identify their knowledge about technical vocabulary.

The second writing task was a text-based prompt, which is a task where students are presented with a text to which they have to respond to in their writing (Coombe, Folse, & Hubley, 2007, p. 71). In that sense, Coombe, Folse, and Hubley (2007) pinpoint that

> reading is widely regarded as an interactive skill in which the background knowledge or schemata that the reader brings to the task is constantly interwoven with the new material. There are many processes involved in reading, but also important are the products or results of reading. (p. 45)

When a text is read, there is an interconnection of many factors that lead to the understanding of the material, but as the authors mention, the results or output when reading occurs are highly important as well. Coombe, Folse, and Hubley (2007) point out that English as a Second Language (ESL) and English as Foreign Language (EFL) literature generally bring up two types of writing known as free writing and guided writing. These authors explain that

> free writing requires students to read a prompt that poses a situation and write a planned response based on a combination of background

> knowledge and knowledge learned from the course. Guided writing, in contrast, requires students to manipulate content that is provided in the prompt, usually in the form of a chart or diagram. (p. 76)

Thus, in the diagnostic test there is a task that combines reading and writing to diagnose the students' ability to understand and respond to emails, in which they had to read the email and reply with their opinion for the assembly of a project and the quote of components. In that regard, reading served as the input for writing in a way that students needed to understand the message to come up with an appropriate response; therefore, reflecting what the theory about free writing states. There are also sub-skills of writing involved in the task. The instructions asked the students to state the requirements, provide the response to the question, properly conclude the response, and use an appropriate salutation and closing. Thus, as students replied to the email, they were expected to use an appropriate voice as the audience was a client, so the selection of grammar was expected to be a more formal one. Celce-Murcia (2001) states that writing assignments "should be carefully constructed to assure their success and contribution to promoting the goals of the course" and provides six guidelines for the preparation of successful writing assignments. One of these guidelines is that "a writing assignment should be presented with its context clearly defined", and the third guideline claims that "the language of the prompt or task and instructions it is embedded in should be unambiguous, comprehensible, and transparent" (p. 226). Both are principles that describe the written tasks designed for the diagnostic test.

Reading. Students were expected to be able skim to get the gist or main idea of the email, scan for specific details to reinforce their understanding of each of the components mentioned and what their expected functions were, as well as establish relationships between ideas. All of the skills mentioned above derive from Coombe, Folse, and Hubley's (2007), categorization of major reading skills (p. 45). Another important aspect when assessing reading is text selection. Coombe, Folse, and Hubley (2007) state that "the best way to develop good reading assessment is to constantly watch for appropriate material" (p. 50), and this includes using authentic texts. Selecting authentic materials will help assess students on the understanding of real life texts.

The text selected for the second reading task was chosen based on the needs of the population, which were to be able to read and understand scientific articles about mechanical engineering, and a crucial aspect of this is to comprehend the abstract. This reading task included an authentic abstract from a mechanical engineering article for students to read and provide a response to different questions based on the information stated in the abstract. This abstract was chosen considering "that the conceptual level of the carrier content must be neither trivial nor distractingly high and there must be both value and interest to it" (p. 99) as suggested by Dudley-Evans and St John (1998). The questions of the tasks combined two formats, which are multiple-choice and short answer. The three multiple-choice questions were included since a multiple-choice question "is well-suited for testing the ability to distinguish between main ideas and supporting details" (Coombe, Folse, & Hubley, 2007, p. 54), as well as their ability to comprehend above the sentence level (Coombe, Folse, & Hubley, 2007). The short answer question demanded students “to read receptively or intensively, a form of careful reading aimed at discovering exactly what the author seeks to convey” (Cohen, 1994, p. 218), which helped to recognize the students’ ability to scan information and “to check their grasp of main ideas” (Coombe, Folse, & Hubley, 2007, p. 58). This task also involved reading for meaning which “involves the activation of networks of real-world and rhetorical information for the purpose of interpreting texts” (Cohen, 1994, p. 213).

The last reading tasks consisted of a matching exercise where students needed to read the information provided in each column and match it correspondingly. This kind of task fits into the category of sequence tasks which according to Coombe, Folse, and Hubley (2007) are a way to “check students understanding of the organization of a text. . . because they focus on seeing how the parts of a text fit together” (p. 60). In addition, this reading task assesses the students’ sub-skills stated by Coombe, Folse and Hubley which are to scan for specific details and to establish overall organization of a passage. The content of this task was chosen based on one of the principles for assessing reading comprehension proposed by Cohen (1994): “choose a text with a familiar topic, that is interesting, has an unambiguous intent, and is of an appropriate length” (p. 250). Brown (1998) proposes several purposes for assessing reading, among which he mentions “to assess reading comprehension and critical thinking abilities, to help students read material above their level, and to practice reading by figuring out a text’s organization" (p. 255). However, there are other three purposes that Brown (1998) mentions which are related to tasks that like the ones designed for this diagnostic test, combine reading and vocabulary: "to assess students' comprehension of written descriptions, to assess students' vocabulary development and comprehension, and to read with a specific purpose while inferring words from definitions and context" (p. 255).

Listening. Listening was selected as one of the least needed skills for mechanical engineers, yet listening is a critical skill when it comes to the right development of oral communication skills. Coombe, Folse, and Hubley (2007) state that "the listening process is internal and not subject to direct study and observation. To learn to speak, students must first learn to understand the spoken language" (p. 90). Thus, two listening tasks were included in the diagnostic test to assess the students' ability to understand technical spoken language from different contexts and to assess different micro skills. The first tasks included two listening cloze activities, in which "students listen to a passage while referring to a written transcript of the text in which several words have been deleted. Students are asked to fill in the blanks while listening" (Coombe, Folse, & Hubley, 2007, p. 99). Most of the deleted words for these tasks were technical terms since the aim was to measure to what extent students recognized mechanical engineering vocabulary. This type of task named dictation as a communicative task, "can serve as a measure of auditory comprehension if it is given at a fast enough pace so that it is not simply a spelling test" (Cohen, 1994, p. 259). The second listening consisted of two multiple choice activities where students needed to listen to a recording of a video explaining the constraints and functioning of a machine. This listening text was chosen because “research has indicated that we can expect better performance on aural comprehension of more orally oriented texts” (Cohen, 1994, p. 259). Cohen (1994) proposes this type of task named lecture task, in which “the respondents hear a lecture, with all the false starts, filled pauses, and other features that make it different from oral recitation of a written text” (p. 259). Dudley-Evans and St John (1998) also support this type of task for listening in a way that supports our choice of task by stating that

> the ability to follow monologue, specifically a lecture, is particularly important in EAP situations and has received a great deal of attention in both research and teaching materials. In EOP situations, doctors and other professional people attend conferences and listen to presentations; technicians have to listen to and understand instructions; business people and other professionals listen to policy presentations. (p. 102)

Moreover, Coombe, Folse, and Hubley mention that a multiple-choice task “can be used to assess listening content” (2007, p. 99), including the understanding of main ideas, technical definitions and description of processes. Other micro skills related to listening which are necessary for effective comprehension of monologue are listed by Dudley-Evans and St. John (1998). These skills refer to the “ability to identify the purpose of the monologue, identify the topic of the lecture, recognize key lexical items related to the topic, and deduce meanings of words from context" (p.102), hence the features of the listening tasks created for the diagnostic test.

Speaking. Speaking is the most sought-after skill for people learning a new language. Even when most of the students and stakeholders categorized speaking as the least needed skill for mechanical engineers, they selected it as the most wanted one. Coombe, Folse, and Hubley, (2007) point out that "when testing this skill, we want to simulate real-life situations" (p. 112). For our population, this meant finding speaking tasks that mechanical engineers will carry out. In the diagnostic test two speaking tasks were included which consisted of prepared monologues. In a prepared monologue "the teacher provides students with a written topic card. Students have one minute to make notes and then present their remarks on the topic" (Coombe, Folse, & Hubley, 2007, p. 121). For this specific task, students were prompted with a written mechanical engineering situation and context, and they needed to provide an oral response based on the given information. The tasks were designed to assess speaking micro-skills such as accuracy, use of technical vocabulary, fluency, and content. The difference between the two tasks lay in their level of complexity. For the first one, students were expected to introduce themselves and describe a product. Thus, they only needed general background knowledge about mechanical engineering. On the other hand, for the second task, students were prompted to provide a solution for a specific issue; thus, they needed to be familiarized with the expressions and technical terms related to the problem in order to provide an answer. Both speaking tasks, however, aimed at authentic communication and language use, often called performance activities as proposed by Brown (1998), which should meet four conditions: “the students should be asked to do something with the language, in the process they should be performing some sort of meaningful task, the tasks should be as authentic as possible, and the tasks must typically be rated and scored by qualified judges” (p. 313). These types of tasks were created and chosen for two reasons. First, because they “allow teachers to assess the students in contexts that simulate authentic language use. . . and promote positive washback” (Brown, 1998, p. 314); and second because “they force respondents to be creative in the use of responses that are socioculturally and sociolinguistically appropriate in order to carry out a specified task” (Cohen, 1994, p. 272). Finally in relation to speaking, a warm up section was included prior to the oral tasks because “regardless of the speaking abilities being assessed, allowing time for a genuine warm-up exercise will probably enhance results” (Cohen, 1994, p. 276).

Number of Items Used

In order to ensure the reliability of the results of the test, each of the macro skills contemplated the completion of more than just one task. Thus, each of them presented the participants with two or more items because having had only one would not have allowed to properly measure the students’ proficiency level. In addition to this, each of the tasks displayed a degree of challenge that was superior to the previous one. Therefore, the number of items were distributed as follows:

- Reading: this macroskill was assessed through two different tasks, adding up to a total score of 15 points. For the second task created to assess writing, students were expected to read and properly understand a text to produce a written response, thus creating a strong connection between the two macro skills.
- Writing: two different tasks were designed to assess writing, representing 37 points from the test.
- Listening: this macro skill was assessed through two different tasks that together represent 28 points of the test.
- Speaking: students were expected to complete two tasks, which added up to a total of 25 points of the test.

Tasks Design

The tasks for the test were designed in a way that proficiency levels were represented by an integrative scale for a better organization and analysis of the data gathered through the diagnostic test. The Common European Framework of Reference (CEFR) was used for the test and syllabus design, and the reasons for selecting this framework are presented as follows: the use of performance-based statements, the detailed description of proficiency levels, the guidance offered for syllabus design, and the input provided for the creation of rubrics.

This framework offers raters the criteria for the design of holistic scales that reflect “a consensus view of the characteristics of different levels of language ability” (Green, 2014, p. 154). Furthermore, the Council of Europe explains that the CEFR is a transparent, coherent, and comprehensive reference instrument used in Europe and many other countries and languages, and that it is the result of 20 years of investigation. It was “designed to provide a transparent, coherent and comprehensive basis for the elaboration of language syllabuses and curriculum guidelines, the design of teaching and learning materials, and the assessment of foreign language proficiency” (Common European Framework of Reference for Languages, n.d.). Thus, for in-service and novice teachers, this framework serves as a useful starting point for the evaluation of students’ weaknesses for course design purposes.

Several other authoritative sources rely on the CEFR for assessment and curricula development. Cambridge English assessment values the benefits this framework provides to teachers, learners and employers in describing language ability on a six-point scale by stating that

> this makes it easy for anyone involved in language teaching and testing, such as teachers or learners, to see the level of different qualifications. It also means that employers and educational institutions can easily compare qualifications to other exams in their country. (Cambridge English Assessment, 2019.)

A similar position is held by English Testing Services (ETS) and its global subsidiary on the international and professional mobility of the CEFR, since their view on this framework represents a reference system that is designed to establish co-relations between various tests and ability levels. TOEIC and TOEFL, two well-known tests administered by ETS worldwide, are based on the CEFR which “means that test takers, teachers, and people making decisions based on the results of these tests (universities, employers etc.) can use the CEFR to compare the performance of a test taker against any test in any language” (ETS, 2012).

Cambridge University Press goes beyond the limits of the usefulness of CEFR for school directors, syllabus designers, teachers, teacher trainers and proficient learners. In its Introductory Guide to the Common European Framework of Reference (CEFR) for English Language Teachers (2013), Cambridge explains that the significance of CEFR in language learning and teaching is due to the fact that it goes beyond merely describing learner levels.

> It has underpinned a particular approach to language learning as the one most commonly recommended or expected in language teaching today. This approach is based on the notion of communicative proficiency – the increasing ability to communicate and operate effectively in the target language. The descriptions of levels are skills-based and take the form of Can-Do statements. (2013)

These Can-Do statements become highly useful when designing a task-based syllabus because they offer detailed performance statements that clearly illustrate the degree to which students should be able to complete a task depending on their language proficiency. This same guide exemplifies different practical uses of the CEFR: syllabus development, exam/test creation, exam marking, language learning needs evaluation, course design, and learning materials development among others. Green (2014) claims that the best methods for rating scale development are said to take advantage of the strengths of a range of intuitive, quantitative and qualitative approaches, and that “the CEFR brings together all three” (p. 155).

There are abundant reasons why the CEFR provides support in the description of objectives, content and methods in second and/or foreign language education. As novice teachers, this is part of the researchers' rationale behind the selection and development of the tasks in the diagnostic test of this study.

Rubrics Used for Assessing Speaking and Writing

The rubrics that were chosen in order to assess speaking and writing were analytic due to the significant amount of advantages they could bring, in this particular case, to the diagnostic assessment of the participants. Even though analytic rubrics can take longer to be created and used, they highly contribute to a better identification of strengths and weaknesses in the students. O'Malley and Valdez Pierce (1996) mention that these rubrics "are most effective for communicating diagnostic information, such as students' strengths and needs" (p. 66). In addition to this, the choice was also made based on Davis (2015), who points out that "analytic rubrics provide separate scores for various aspects of performance, and in this sense provide more detailed information regarding the test taker's abilities" (p. 241). The same authors point out that these rubrics facilitate the job of raters when test takers show important differences in their strengths and weaknesses.

In regard to the foundations to put these rubrics together, the Common European Framework served as the agent that defined the descriptors of the rating scales. This framework "has developed a description of the process of mastering an unknown language by type of competence and sub-competence, using descriptors for each competence or sub-competence" (Council of Europe, n.d.).

Having mentioned that, the rubric designed for the speaking tasks (see appendix J) reflects the three different types of users ranging from basic (A1 and A2), to independent (B1 and B2) and finally to proficient (C1), according to CEFR. However, for the purpose of this project, the scale created ranges from 1 being the lowest score to 5 being the highest, reflecting here the A1 to C1 levels mentioned before. Another referent for the creation of this rubric is the self-assessment grid in the section of spoken production, which according to the Council of Europe, is a tool that orients learners and teachers "to profile their main language skills, and decide at which level they might look at a checklist of more detailed descriptors" (n.d.). The reason why only five out of the six proficiency levels were included is because most of the participants indicated to have a beginner and intermediate level, so this needed to be confirmed through the descriptors starting from A1 (1) and finishing in C1 (5) to be able to see if some outliers could perform better than they indicated. This rubric designed for spoken production also contemplated frequency in each of the criteria in order to avoid overlapping across components, and finally, they assessed participants in terms of grammar, vocabulary, content, pronunciation and intonation, and fluency.

Furthermore, two more analytic rubrics were developed to assess the written production of the participants. For these ones, the proficiency categories contemplated the broad groups in which users of a language are distributed according to CEFR, which are basic, independent, and proficient. Thus, the first rubric for written production ranged from 1 being the lowest score to 3 being the highest one, whereas the second rubric assigned three ranges to the task so that students could obtain 1, 3 or 5 points for the five different descriptors included. It is important to point out that two different rubrics were created because of the level of challenge of each of the writing tasks. In addition, each of the descriptors in the rubrics shows a clear degree of change to match what students are able to achieve based on the previous proficiency levels and avoid overlapping across them. The first rubric for written production assessed learners on task completion, vocabulary, grammar and mechanics (see appendix K), and the second one assessed them on task completion, vocabulary, grammar, mechanics, and organization (see appendix L).

Types of Parameters Used for Assessing Reading and Listening

The foundations for assessing reading and listening in this diagnostic test were also supported by CEFR parameters. This framework guided the choice and design of the tasks as it provides its audiences with very specific performance samples that reflect the different proficiency levels mentioned in the previous section. The Council of Europe says that "reading and listening are very active processes", and both imply "internal processes of verbal comprehension" (CEFR Illustrative Tasks: Reading and Listening, n.d., p. 3). Thus, in order to design and choose the most appropriate tasks for the diagnostic test, the researchers of this study carefully selected the ones that would allow students to perform these internal processes in the most suitable way. Having mentioned that, the following sections will provide details on the rationale and foundations for the design of reading and listening tasks.

First, the reading section exposed students to three different tasks: a) reading an email from a client to demonstrate understanding it and respond to it appropriately, b) reading the abstract taken from a scientific article and then answering questions related to it in a multiple choice exercise along with an additional open-ended question to state the main idea, and c) completing a matching exercise about a series of problems some equipment experienced and the corresponding solutions. Each of the tasks valid for the purpose of the diagnostic test based on Brown's (2004) principles challenged students to move strategically through some of the parameters by CEFR that could test them at different proficiency levels. Firstly, the activity in which they had to read and comprehend an email to formulate a written response was tailored to match the descriptor from the Reading for Orientation illustrative scale by the CEFR, that says that an independent reader "can scan longer texts in order to locate desired information, and gather information from different parts of a text, or from different texts in order to fulfill a specific task" (Council of Europe, 2001, p. 70). This was the first step to test students' capacity to complete a task, in this case an everyday task in their field. In order to respond to the email, they had to gather and comprehend information from different parts of the email and scan it to get specific details that would allow them to write an appropriate reply. Second, they were challenged to test to what extent they were able to understand complex texts. The CEFR descriptor for a proficient user of the language in the Overall Reading Comprehension illustrative scale, states that the individual "can understand and interpret critically virtually all forms of the written language including abstract, structurally complex, or highly colloquial literary or non-literary writings" (Council of Europe, 2001, p. 69). This descriptor set the second parameter to assess another high frequency reading task for mechanical engineers, which is reading scientific articles. Not only did they have to answer three multiple-choice questions, but also at the end, they were expected to state the main idea of the abstract by using their own words, which elevated the level of challenge of the task. Finally, after taking students to the highest peak of challenge, they encountered a final reading task in which they were expected to match equipment problems with the corresponding troubleshooting steps, which contemplates a very important component of reading manuals in their field. The CEFR in its Reading Instructions illustrative scale states that an independent user of the language "can understand lengthy, complex instructions in his field, including details on conditions and warnings, provided he/she can reread difficult sections" (Council of Europe, 2001, p. 71).

The assessment of listening, the other receptive yet active skill, also happened based on specific CEFR parameters. In this regard, students encountered two different tasks. First, they had to listen to an audio about how a refrigerator works and fill out the blanks with words that were missing; then, they had to listen to an excerpt from a talk about perpetual motion machines and get specific details and make inferences to answer multiple-choice questions. The descriptor used as the foundation for the first task was taken from CEFR's Overall Listening Comprehension illustrative scale. This one says that a person at an independent level (B1) "can understand straightforward factual information about common every day or job related topics, identifying both general messages and specific details, provided speech is clearly articulated in a generally familiar accent" (Council of Europe, 2001, p. 66). As explained in the previous descriptor, the listeners were presented with a task that expected them to understand specific details in a message that contained vocabulary items from a topic related to their field of study. Here, they were also presented with an audio whose speech was clearly articulated. On the other hand, the second task intended to move them to a next level of challenge. To shortly mention it again, the students had to listen and then answer multiple-choice questions. The CEFR states as one of its comprehension descriptors in the Overall Listening Comprehension scale that a listener at the second category of the independent level (B2) “can understand the main ideas of propositionally and linguistically complex speech on both concrete and abstract topics delivered in a standard dialect, including technical discussions in his/her field of specialization” (Council of Europe, 2001, p. 66). Having pointed that out, the second task had them understand more complex speech and answer more elaborate questions that required them to infer information based on the listening text.

Results and General Implications

Results were analyzed on an individual basis through the elaboration of detailed individual profiles and a summary of the diagnostic test results (See appendix M) where strengths, weaknesses, and the proficiency level are condensed. The only exception to task completion was one student who left one of the writing tasks blank. The rest of the students completed all the tasks of the test. We will discuss the results for each of the macro skills later on. However, to start with, it is necessary to indicate how students performed in general terms after taking the diagnostic test. As can be seen in figure 4, only 15% of the students reached a grade between 86 and 96 which is the highest range, whereas the lowest grade range went from 66 to 76, which corresponds to 35% of the participants. There was also a significant number of students who obtained a low grade ranging between 56 and 65 representing 30% of the participant population. The details of the overall performance are displayed in Figure 4.

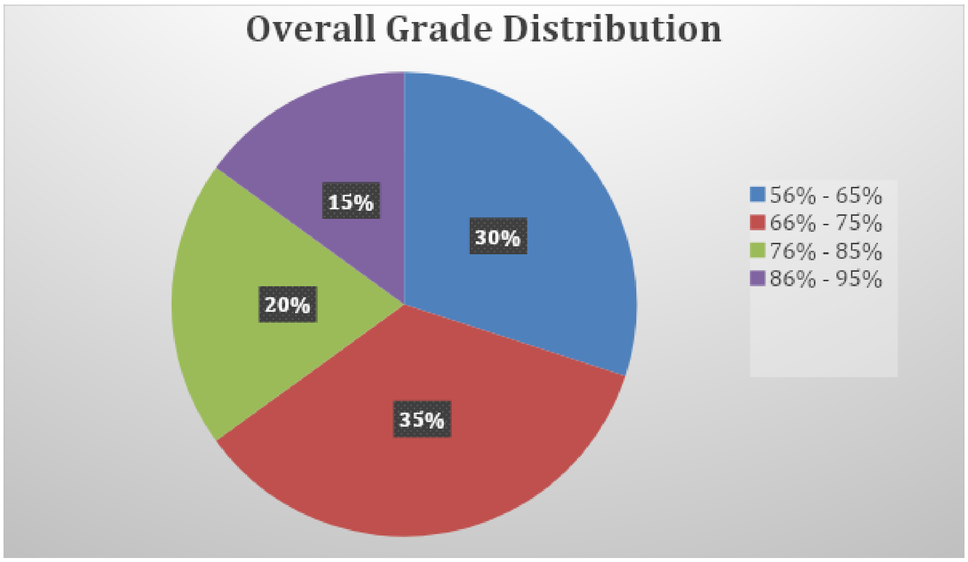

Figure 4. Overall grades obtained in the diagnostic test for mechanical engineers

The results shown above will now be explained more in detail through the analysis of the participants' performance in each macro skill. In the case of the first reading task, which dealt with an abstract, only one student was able to answer all items correctly, and only one answered all questions incorrectly, placing 90% of the students in scores between 0 and 7, from which 70% scored between 4 and 6. This implies that even though most students were able to complete the task to a basic level of proficiency, there is still a lack in their reading ability that needs to be addressed in the course so that in the future they are able to complete similar tasks more at ease.

Furthermore, for the second task about manuals, only 20% of the students scored all points, and the lowest score was 3 out of 8, achieved by 15% of the students. These results give us 67.5 % of students in middle ranges or scores, falling into the independent user category for reading since they were able to read and understand texts that consist mainly of job related language and find specific and predictable information, as described by the CEFR.

Writing seems to be a stronger skill for the students tested. The lowest score for task 1 was 7 out of 12 and for task 2 the lowest score was 11 out of 25, and in both tasks 20% of the students obtained all of the possible points for the task. CEFR explains that independent users can write simple connected text on topics which are familiar and can produce clear detailed texts to explain a viewpoint giving reasons in support of or against a particular point of view. These can-do statements describe what 90% of the students were able to do for task 1 and task 2 in the writing section. In relation to language use, a common mistake that was observed in both writing tasks is the misuse of passive voice, mostly when needed in simple present or simple past. More than half of the students attempted to write utterances containing passive voice but failed at structuring the sentences by omitting the verb to be, using the wrong participle, or by using the verb in infinitive form. The correct use of infinitives of purpose is another lack in terms of language that was identified in the writing section of the diagnostic test.

In the case of listening, the scenario is not very different since 80% of the students scored between 73 and 100 for the first task whereas for the second task 85% of the students scored between 50 and 80. This last percentage was the highest score for the second task. These results show that mechanical engineering students in this study can understand phrases and high frequency vocabulary related to mechanical engineering as well as catching the main point of clear standard speech, which are abilities that according to CEFR describe independent users of the language. However, both the mistakes in the diagnostic test and the previously mentioned percentages also show that some students were unable to infer from the listening text as well as identify paraphrased ideas in the items about the listening texts. Therefore, this implies the course needs to include similar tasks so that all students reinforce these sub-skills.

Some examples of the most common mistakes found in both the writing and listening sections refer to spelling. In the case of writing, in some cases students used technical vocabulary correctly in the context but with wrong spelling issues of all sorts. In the case of listening, most students made spelling mistakes for technical vocabulary despite catching the right words in the listening task, while other students were completely unable to understand some of the words they needed to write in the blanks.

Finally, for speaking, the results show that most of the students who took the test are basic users of the language. The maximum number of points for each speaking task was 25 according to the rubric, and the descriptors set a minimum of 20 points for the performance to be considered acceptable. For task 1 only one student obtained less than ten points whereas 16 students scored between 11 and 19 points. Only 3 students scored between 20 and 25 points for task 1. For task 2 the same 3 students scored again between 20 and 25 points whereas 4 students obtained less than ten points. The majority of students, 13 of them, scored between 11 and 19 points for task 2.

Independent users can connect phrases in a simple way in order to describe and briefly give reasons and explanations for opinions and plans as well as present clear, detailed descriptions on subjects related to their field and explain a viewpoint for different perspectives. The majority of the students could not perform those functions and apply those skills at ease on the diagnostic test, placing them as basic users overall. Even though all students completed the oral tasks, there was an evidenced lack of details and supporting ideas, as well as the presence of limited explanations and isolated ideas in some cases. In terms of language, the most common mistakes found in the speaking tasks are related to the incorrect use of the passive voice, gerunds and infinitives, simple present tense, and modals. The correct pronunciation of technical words is another area that needs emphasis during the course, as well as the incorporation of more complex technical vocabulary. Furthermore, fluency did not seem to be a problem. All the details on how students performed in each of the major areas of the language can be visualized in figure 5, which displays the overall grades obtained per macro skill.

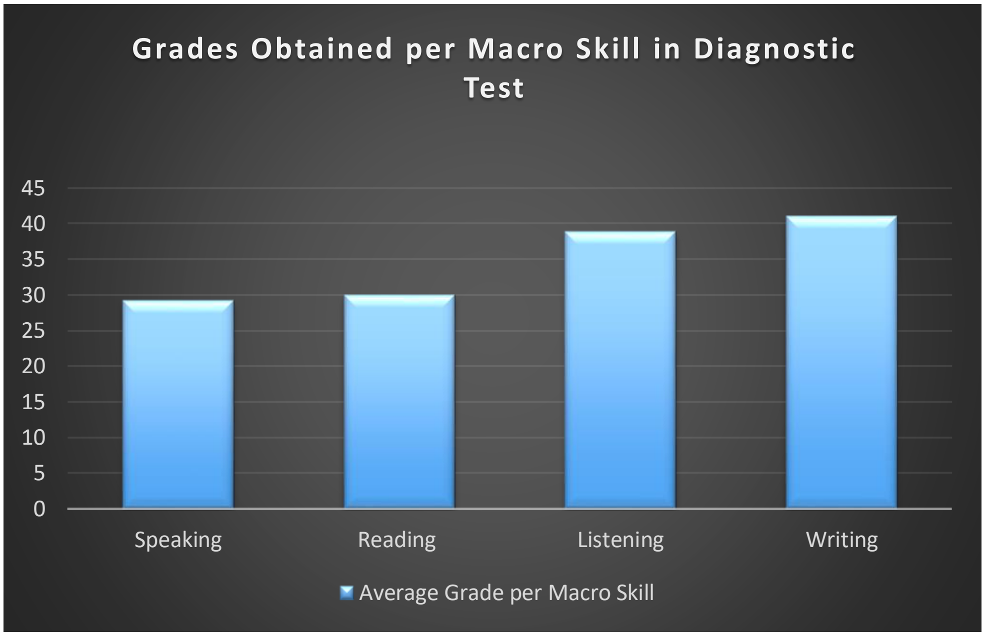

Figure 5. Average grade distribution per macro skill obtained after the application of the diagnostic test for mechanical engineers

Course Design Implications

The diagnostic test administration process complied with the assessment principles of validity and reliability based on the guidelines Brown (2004) and Coombe, Folse and Hubley (2007) provided, allowing us to collect the necessary information to design the course. The results obtained from the test show that the areas that should be more relevant in the design of the syllabus are reading and writing so that students are able to improve based on their needs, wants and lacks. On the other hand, listening and speaking are not as relevant for mechanical engineering students according to the students in this study. However, these macro skills should also be included in the syllabus for reinforcement because the field of work for this population requires it, and because the participants requested the speaking skill for the course as one of their wants. Taking into consideration learner wants and recommendations is also crucial as Hutchinson and Waters (2000) pointed out.

Chapter II: **Syllabus**

Course Logo

The elements contained in this logo are chosen as an analogy of the language learning process as well as the purpose of the course. The first element which is the box, represents the brain; the gears, which are an elemental part of mechanical engineering, represent the language and ideas that will emerge and make a “machine” work to produce larger pieces or processes throughout the course.

Course Name: The Gearbox: Engineering your English

Course Description

This is an ESP course for mechanical engineering students at UCR, intended for basic and independent users according to the parameters of the

CEFR. The course will be taught by two language instructors, once a week on Mondays from 5:00 p.m. to 7:50 p.m. at UCR and will last fourteen weeks with a total of 42 hours. All four macro skills will be addressed through exposure to real-life tasks, strategies for micro skill development, and authentic materials, which have been carefully designed and chosen so that students are able to achieve the course goals and objectives. In this course students will be able to demonstrate comprehension of technical engineering texts, write specific documents related to the field, and orally exchange technical information with others. The syllabus has been organized in a way that each unit focuses on one macro skill, and each unit allows students to carry out tasks and apply strategies for target situations. The details of the syllabus for the mechanical engineering course are developed in the following sections, and a student version was also created so that participants keep it as part of the official documents of the course they will take (See appendix N).

Statement of Goals and Objectives

The goals and objectives for the course “The Gearbox: Engineering your English” were developed based on the participants’ needs, lacks, and wants. They were divided into three units addressing a particular macro skill and following a scaffolded sequence to facilitate students’ learning. They were developed as follows:

Unit 1. Expanding your Knowledge

Goal: By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies.

General objectives:

By the end of the lesson, students will be able to:

1. Accurately define general mechanical engineering vocabulary by guessing meaning from the context of written texts about general mechanical engineering topics.
2. Successfully identify the main ideas and details in sample texts about new technologies by using skimming and scanning strategies.
3. Correctly recognize the purpose of formal work email samples by summarizing and restating the purpose of the emails.

Unit 2. Engineering Production

Goal: By the end of the unit, students will be able to write emails, descriptions of procedures and processes, as well as lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.

General objectives:

By the end of the lesson, students will be able to:

1. Properly write inquiry emails to experts in mechanical engineering by following the format of sample emails provided.
2. Coherently write the description of mechanical procedures in the workplace by clearly listing the steps required for the procedure to be completed.
3. Accurately construct a one-page lab report introduction by including the what and the why of a study or an experiment for informative purposes.

Unit 3. Exchanging Ideas

Goal: By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues, and superiors by actively listening to, asking questions, and reporting information orally.

General objectives:

By the end of the lesson, students will be able to:

1. Successfully demonstrate understanding of information presented orally by experts by asking questions and providing appropriate responses.
2. Appropriately discuss technical processes with English-speaking colleagues by sharing their point of view and exchanging ideas in order to find the most suitable solution.

3. Accurately explain a future project design to clients, superiors and colleagues by organizing the ideas, and including details and the necessary technical vocabulary.

Methodology

Approach: Task-Based Approach

The syllabus has been designed within the reach of the Task-Based Approach. Shehadeh (2012) defines Task Based Language Teaching (TBLT) "as an educational framework and an approach for the theory and practice of second/foreign language learning and teaching, and a teaching methodology in which classroom tasks constitute the main focus of instruction" (p. 156). In other words, it refers to "an approach based on the use of tasks as the core unit of planning and instruction in language teaching" (Richards & Rodgers, 2001, p. 223). The framework of this approach consists of pre-tasks, the main task in which there is a planning phase and a report phase, the post task, and the language focus formed by the analysis and practice stages; as explained by Willis (n.d.). The rationale behind the choice of this approach lies in the fact that there are favorable conditions for learning to occur when students are engaged with tasks since "task work provides a better context for the activation of learning processes than form focused activities" (Richards & Rodgers, 2001, p. 223).

The theory of language and learning behind this approach offers several reasons why TBLT is a valid choice for the design of the ESP course for mechanical engineers. The theory of language assumes that language is the primary means of making meaning, and making meaning is key for our prospect students to be able to transfer the class content into the workplace. It also assumes that lexical units are central in language use and learning. As explained by Richards and Rodgers (2001), “vocabulary is here used to include the consideration of lexical phrases, sentences stems, prefabricated routines, and collocations, and not only words” (p. 227). Satisfactory English performance in the field of mechanical engineering involves a very frequent use of technical lexical units which will be incorporated in the syllabus and integrated in the different tasks.

It is well-known that TBLT shares the same assumptions for the theory of language that underlie Communicative Language Teaching, but Richards and Rodgers (2001) mention some additional principles that are crucial in TBLT and which also serve as determining rationale behind the choice of this approach for our syllabus design. One of the principles proposed by these authors is that tasks provide both the input and output processing necessary for language acquisition, and they believe these are key processes for language learning considering that “tasks are believed to foster processes of negotiation, modification, rephrasing and experimentation that are at the heart of second language learning” (Richards & Rodgers, 2001, p. 228). The tasks designed for the syllabus were meant to involve those processes in order to aim at high order thinking which is highly necessary at work for the target population of the course.

The second principle is that task activity and achievement are motivational, which Richards and Rodgers (2001) justify by claiming that tasks are also said to improve learner motivation and, therefore, promote learning

> because they require the learners to use authentic language, they have well-defined dimensions and closure, they are varied in format and operation, they typically include physical activity, they involve partnership and collaboration, they may call on the learners' past experience, and they tolerate and promote a variety of communication styles. (p. 229)

This syllabus is designed and tailored for an ESP population; therefore, it demands the use of authentic language in order to resemble real-life contexts and scenarios as well as varied and collaborative tasks due to the nature of the job of mechanical engineers and the use they make of the language at work. The third principle for TBLT claimed by Richards and Rodgers (2001) strongly fits our syllabus: learning difficulties can be negotiated and fine-tuned for particular pedagogical purposes. Richards and Rodgers (2001) suggest "that tasks can be designed along a cline difficulty so that learners can work on tasks that enable them to develop both fluency and awareness of language form" (p. 229). This allows us to adjust the difficulty of tasks in order to alternate fluency and accuracy activities according to students' needs, progress, and performance along the course.

Classroom Dynamics

When teaching a class, there is more than developing the appropriate language, knowledge, and competencies, and that is where fostering the right classroom dynamics comes into play. Classroom dynamics refers to "the ways the people within a class interact with each other. It's how they talk and how they act; it's how they show their feelings and opinions; it's how they behave as a group" (Oxford University Press, 2016). Thus, the way all members of a classroom community interact will highly influence the flow and success of a lesson, and in our case, of a course.

This course for mechanical engineers will be taught by two student-teachers, whose roles will be clearly distributed in each class in order to successfully teach the lessons planned for the practicum. This will also go hand in hand with the generation of an appropriate learning atmosphere. During each lesson, the instructors will be alternating roles so that one of them can lead the class and the other one can act as an assistant. When it comes to being the leader student-teacher, the routine will include arranging the space for the class and asking the other teacher for help if necessary. Then, when class starts, the leading teacher will welcome students, check attendance, explain the objectives of the lesson, and of course, conduct the class by giving instructions for the tasks, monitoring, answering students' questions, wrapping up the class, and giving feedback. These functions will be developed as the instructor takes the role of a guide or facilitator, which will be explained in more detail below. On the other hand, the role of the instructor who is not teaching will require her to cover several responsibilities. The first one consists of assisting the leader teacher to check that everything is ready for the class, serving as a model for some tasks when necessary, monitoring students' production, checking on even participation from students, and more importantly, serving as a "secretary". This last function means observing the class and taking notes on any type of situation that may come up and that will likely influence the flow of the next session(s). The instructors will be alternating roles as shown in Table 2, considering that each unit will be developed in three lessons.

Table 2.

Instructors' roles alternation per unit in the program.

Role of the instructor	**Lesson 1**	**Lesson 2**	**Lesson 3**
Leading teacher	Garyan	Laura	Garyan
Supporting teacher	Laura	Garyan	Laura

The lessons for the ESP course will happen within a framework of student-centeredness, in which "students will be typically observed working individually or in pairs and small groups on distinct tasks and projects" (Celce- Murcia, 2001, p. 38). TBLT requires teachers to leave out teacher-dominated activities and tasks "while remaining conscious of their students' need for guidance. . ., for appropriate models of and feedback about the target language, and for constructive and supportive evaluation of their progress" (Celce- Murcia, 2001, p. 38). The implications that student-centeredness has on classroom dynamics are that students will have more chances to perform in English and that the instructor will have fewer supervision needs because as stated by Celce-Murcia (2001), students often will pay more attention and learn better from one another since their performances and processes of negotiation of meaning are more closely adapted to one another's level of ability (p. 38). Group work will also be key in classroom dynamics considering that "just as individuals contribute to a group, the different groups in a classroom can be linked through different tasks, roles, and shared responsibilities to generate whole-class tasks and activities" (Celce- Murcia, 2001, p. 38). We should not forget the benefits that group work offers to students, among which Celce-Murcia (2001) mentions “that the observable inhibitions to speak. . . tend to disappear in small group work” (p. 38). All the previous dynamics are targeted to starting and closing the lesson properly, but more importantly towards maintaining the lesson and the students within a healthy teaching and learning environment conditions.

Tasks and Techniques

Defining what a task is has brought many experts to contribute with their perspectives. For example, Richards, Platt, and Weber (1992) define it as “an activity which is designed to help achieve a particular learning goal” (p. 373). Richards and Rodgers (2001) define tasks as “activities which have meaning as their primary focus” and explains that they are “evaluated in terms of achievement of an outcome, and generally bear some resemblance to real-life language use” (p. 224). A more simplistic definition of task is offered by Richards and Rodgers (2001) who state that “a task is an activity or goal that is carried out using language” (p. 224). However, for the purpose of this project, and according to Ellis, (2003) a communicative task is

> a piece of classroom work which involves learners in comprehending, manipulating, producing, or interacting in the target language while their attention is principally focused on meaning rather than form. The task should also have a sense of completeness, being able to stand alone as a communicative act in its own right. (p. 4)

As Ellis points out, a communicative task goes beyond a simple class exercise; in fact, it challenges learners to have a closer contact with the language to make them comprehend, manipulate, produce, and interact with it in a meaningful way that connects to their realities. Having pointed that out, this course for mechanical engineers will foster communication, critical thinking, problem-solving, and creativity through authentic tasks that can help students successfully perform in their major and professional careers. Furthermore, it is also necessary to mention two more components that accompany a task, which are techniques and strategies. To elaborate on these two other components, it can be said that “a technique is a particular method of doing an activity, usually a method that involves practical skills” (Collins English Dictionary, 2019.). Techniques are also defined as a “particular trick, stratagem, or contrivance used to accomplish an immediate objective” (English Teaching Techniques, 2012). In this regard, each task selected for the mechanical engineering course will require students to perform either individual, pair, or group work because depending on the nature and purpose of the task, different types of interactions will be required to successfully achieve the learning objectives. In addition, the course will include different techniques such as self-explanation, summarization, highlighting, imagery use for text learning, rereading, self-monitoring, and peer feedback. Then, according to O’Malley & Uhl (1990), “learning strategies have learning facilitation as a goal and are intentional on the part of the learner” (p. 43). The authors point out that “the goal of a strategy is to affect the learner’s motivational or affective state, or the way in which the learner selects, acquires, organizes, or integrates new knowledge” (p. 43). In this regard, we can see that a task will be even more successful when combined with the appropriate techniques and strategies, which as a result will make students much more aware of their learning and its application in real life. Table 3 below shows one sample task per unit as well as the strategies and techniques involved. For a complete description, refer to the syllabus chart in the content section of this paper.

Table 3.

Sample tasks, strategies and techniques developed for the course.

Unit	Task	Strategies	Techniques
1	Create summary, paraphrase, and quote cards for formal work emails that are asking, explaining or requesting information.	Summarizing information Looking for details Restating /paraphrasing	Individual work. Techniques: "Who does what to whom, when, where, how and why? (WDWWWWH W) and highlighting.
2	Write emails based on the cards created in unit 1 to respond to the inquiry or request with the appropriate formality	Setting the tone Supporting the main idea Proofreading	Individual and pair-work. Peer-feedback technique.
3	Listen to an expert conference and participate in a Q&A session based on the conference	Predicting Listening for signposts	Group work

Techniques adapted from: Durhan College CAFÉ

The previously mentioned tasks will be developed through the combination of pedagogical tasks and target tasks. According to Celce-Murcia (2001) “a target task is something that the learner might conceivably do outside of the classroom” (p. 62), whereas a pedagogical task is “unlikely to be developed outside of the classroom” (p. 62). The pedagogical task is created in order to “push learners into communicating with each other in the target language, on the assumption that this communicative interaction will fuel the acquisition process” (p. 62). Nunan (1988) offers the same view of tasks with a small name variation by calling them real-world tasks and pedagogic tasks. He defines them similarly by stating that the former are “tasks that the learner might be called upon to perform in real life” and the latter as “those tasks that the learner is required to carry out in the classroom” (p. 45). Most of the classroom tasks developed for this syllabus will be unpredictable, creative tasks that require the learners to “assemble the words and structures they have acquired in new and unpredictable ways” (Celce- Murcia, 2001, p. 63). The researchers of this study are aiming at following the key assumptions of tasks in TBLT as summarized by Richards and Rodgers (2001). Tasks will focus on the process instead of the product and will contain basic elements and emphasis on communication and meaning. They will also be sequenced according to difficulty, which will depend on several factors like “previous experience of the learner, the complexity of the task, the language required to undertake the task, and the degree of support available” (p. 224).

Roles of the learners

Students will have the roles of group participants, monitors, risk takers, innovators, and field specialists. Being specialists is crucial in the unfolding of class activities because “ESP learners bring to their language learning some knowledge of their own specialist field and the communication within it” (Dudley Evans & St John, 1998, p.18). Thus, learners are vital for the syllabus and the course. Students’ active participation will be mainly required through pair or small group work that encourages learners to take risks in order to carry out tasks for which “they lack full linguistic resources and prior experience” (Richards & Rodgers, 2001, p. 234). Learners will also have opportunities to self-monitor their language usage in the tasks and be able to detect how language is used when communicating in an oral or written form during class activities.

Roles of the Instructors

The role of instructors in this course will be lesson, tasks, and materials designer; facilitator, resource manager, and an awareness-raising agent. It is the instructor’s duty to develop lessons and materials after careful selection, adaptation, and /or creation of tasks “forming these into an instructional sequence in keeping with learner needs, interests, and language skill level” (Richards & Rodgers, 2001, p. 236). The fact that ESP learners are the main source of knowledge of the specific technical field, automatically awards instructors with the role of facilitators and consultants rather than the sources of input, as well as the role of resource manager rather than resource controller. This happens in ESP contexts and is explained by Dudley-Evans and St. John (1998) as a development “where the teacher knows relatively little about the content that is being taught in the ESP class and proceeds by pulling together and organizing the information that the learners. . . are able to provide about the language” (p. 150). Hence, the facilitator will ask students for materials that have potential to be exploited in class. Making sure that learners are not exposed to the tasks without being ready is part of the facilitation process, so instructors need to achieve this by designing lessons in which students are prepared for tasks beforehand. In order for learners to perceive pivotal characteristics of the language they hear and use, instructors need to employ “a variety of form-focusing techniques, including attention-focusing pre-task activities, text exploration. . . and use of highlighted material” (Richards & Rodgers, 2001, p. 236). This process will give the instructor the role of awareness-raising agent.

Contents

The course to be taught during the second semester of the year 2019 at the University of Costa Rica for mechanical engineers has been divided into three units. The goals to be achieved, general objectives, tasks, language focus, and strategies are detailed in the charts below. Moreover, sample lesson plans and materials have been created to illustrate the contents of this paper (see appendixes R, S, and T).

Unit 1. Expanding your Knowledge

Goal: By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies.

General objectives:

By the end of the lesson, students will be able to:

1. Accurately identify the meaning of general mechanical engineering vocabulary by guessing from the context of written texts about general mechanical engineering topics.
2. Successfully identify the main ideas and details in sample texts about new technologies by using skimming and scanning strategies.
3. Correctly recognize the purpose of formal work email samples by summarizing and restating the reason of the emails.

General Objective	Tasks	Skills	Language Focus	Strategies	Time allotted
1	To read mechanical engineering texts and apply context clues to get the meaning of words from context.	R	**Vocabulary** General vocabulary related to mechanical engineering in different parts of speech [pointed out through antonyms, synonyms, appositives, examples and direct definitions] E.g.: *collar, fitted, sliding, axis, blank, freeze, efficiently, filter (different parts of speech) increase - decrease (antonyms), force-strength (synonyms). Adsorption, the adhesion of gas or liquid molecules or dissolved solids to a surface, is an essential part of the process (appositives).* **Grammar** Simple Present to express facts E.g.: *Solar energy <u>is</u> one of the most widely spread renewable energy sources.* *The boss usually <u>provides</u> a contact surface around the hole.* *The clevis <u>allows</u> rotational motion.* Passive Voice in the present to express facts	Guessing meaning from context	1 lesson

			E.g: *The bearing is the part of the machine within which a rotating or sliding shaft is held.* *A pivoting double lever is used to change the direction of applied motion.* *The broach has serrated edges and is pushed or pulled through the hole to produce the required shape.* **Pronunciation** -ed endings pronunciation. E.g.: used, reduced, quoted		
2	Apply skimming and scanning strategies to complete charts with main ideas and details of scientific articles	R	**Vocabulary** Words related to new technologies. E.g.: *hybrid, gyroplane, 3D- printed steam turbine.* **Grammar** Simple present to express facts E.g.: *Solid polymer helps hold particles together.* *Carbon additives provide electrical connection.* *This study provides the first global view with unprecedented amount of microscopic structural details.* E.g.: Passive Voice in the present to focus the attention on the object. *In this paper, a simplified nonlinear dynamic model with bi-linear springs is*	Skimming and scanning texts Looking for main ideas and specific details.	1 lesson

			proposed and validated for pipe structures with bolted flange joints. T*he relationship of longitudinal and transverse vibration frequencies is discussed.* **Pronunciation** -ed endings pronunciation.		
3	Create summary and paraphrasing cards for formal work emails that are explaining or requesting information.	R S	**Vocabulary** Machine parts and tools. E.g.: *electrovalves, regulators, sensors, tanks, containers, fuel, articulated blade, aspirator, control, robot, pump, tube, compressor.* **Grammar** Simple past tense in the active and in the passive voice to talk about finished actions. E.g: The client requested the quote for the components. The parts were assembled properly. The expert explained the control of the valves for the machine. The turbine was configured following the manual requirements. **Pronunciation** -s endings pronunciation in plural of machine parts and tools	Summarizing information Looking for details Restating /paraphrasing	1 lesson

Unit 2. Engineering Production

Goal: By the end of the unit, students will be able to write emails, descriptions of procedures and processes as well as lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.

General objectives:

By the end of the lesson, students will be able to:

1. Properly write inquiry emails to experts in mechanical engineering by following the format of sample emails provided.
2. Coherently write the description of mechanical procedures in the workplace by clearly listing steps required for the procedure to be completed.
3. Accurately construct a one-page lab report introduction by including the what and the why of a study or experiment for informative purposes.

General Objective	Tasks	Skills	Language Focus	Strategies	Time allotted
1	Write emails based on the cards created in unit 1 to respond to the inquiry or request with the appropriate formality	R W	**Vocabulary** Words related to machine components, requirements, and functions. E.g.: *cylinder, cable, traceability.* **Grammar** Modal verbs (Request, possibility, advice and obligation) E.g: (Request) *Can you quote me these components? / Could you offer me any alternative to replace VP344-5DZ1-02NA?* (Possibility) *The collar might not be necessary for the machine The choice of parts could enhance the performance of the fixture* (Advice) *You should consider installing a third electrovalve.* *(Obligation) You must follow the norms and standards established for the proper functioning of the equipment.* **Pronunciation**	Setting the tone Supporting the main idea Proofreading	1 lesson

			Intonation for yes /no questions E.g.: *Could you offer me another alternative? (rising intonation)*		
2	Create a short manual or guide describing the procedures for the appropriate use of a machine or mechanical equipment.	W	**Vocabulary** Sequencers E.g.: first, before, afterwards, later, finally **Grammar** Imperatives *E.g.: Perform a complete 300 units run.* *Lock system in release position.* *Secure the serrated knife.* *Perform the steps according to the normative* *Customize the size for the specific valve.* **Pronunciation** Sequence words with a focus on ordinal numbers and the production of the "th" sound. *E.g.: third, fourth*	Using graphic organizers (flow chart)	1 lesson

3	Write the informative introduction of a lab report for a scientific magazine on a topic students would like to experiment or study	R W	**Vocabulary** Linking words E.g.: altogether, furthermore, to summarize **Grammar** Infinitives of purpose *E.g.: The following report intends to explain the process.* *The gusset plate is used to strengthen a joint.* *The hasp is needed to fasten the padlock.* *The compressor was installed to enhance the spinning of the turbine.* **Pronunciation** Reduced form of "to" - [tə]	Mind mapping Writing a topic sentence	1 lesson

Unit 3. Exchanging Ideas

Goal: By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues and superiors by actively listening, asking questions, and reporting information orally.

By the end of the lesson, students will be able to:

1. Successfully demonstrate understanding of information presented orally by experts by asking questions and providing appropriate responses.
2. Appropriately discuss technical processes with colleagues by sharing their point of view and exchanging ideas in order to find the most suitable solution.
3. Accurately explain a future project design to clients, superiors and colleagues by organizing the ideas, including details and the necessary technical vocabulary.

General Objective	Tasks	Skills	Language Focus	Strategies	Time allotted
1	Listen to a segment of an expert conference and participate in a Q&A session.	L S	**Vocabulary** "If" and "whether" in indirect yes/no questions. **Grammar** Direct and indirect questions and statements. *E.g.: Do you know what an alternative process could be to adapt these valves to the components?* *Can you tell me whether the equilibrium point is reached in these conditions?* *I'd like to know if the epicyclic gearing system includes an outer ring gear.* *What are the functional requirements for the Test Box?* **Pronunciation** Intonation for -Wh questions (falling intonation).	Predicting Listening for signposts	1 lesson
2	Discuss different points of view on several case studies about mechanical engineering processes and create a project design proposal.		**Vocabulary** Phrases for agreeing and disagreeing. E.g.: I agree, I am not sure about that.	Turn-taking strategies	

			Grammar First conditional *Eg: If the machine is installed following the manual, the project will be smooth.* *The design will include three different models if you agree.* *I am not sure if the proposal will be accepted if this information is not included.* **Pronunciation** The /i/ and /ɪ/ sounds E.g.: [wɪl]		
3	Explaining detailed information about the project proposal to others in a meeting	S	**Vocabulary** Future time markers *E.g.: in the next few days, a year from now, for around three weeks* **Grammar** Simple future in active and passive voice to express plans and willingness. *E.g.: The components <u>will be assembled</u> once we get green light on the project.* *Troubleshooting services <u>will back up</u> the project.*	Getting someone's attention Use of fillers	1 lesson

			The model <u>will contain</u> high quality components. *The project <u>will be approved</u> after revision.* **Pronunciation** Thought groups		

Chapter III: Assessment

Even though assessment plays a similar role in a general English course and in an ESP course, there are some distinctions made by some authors. Paltridge and Starfield (2013) indicate that a difference between assessment in other language areas and ESP assessment is that there is an existing “relationship between language ability and language knowledge” (p. 369). On the other hand, Bailey and Curtis (2015) explain that task authenticity and the interaction between language knowledge and specific content knowledge are the two main differences between ESP and general English assessment development and, therefore, ESP test tasks “should share critical features of tasks in the target language use situation of interest to the test takers” (p. 249). This view is shared by Paltridge & Starfield, (2013) by claiming that

> it should always be part of the construct of specific purpose tests that learners’ specific purpose language needs include not only linguistic knowledge but also background knowledge relevant to the communicative context in which learners need to operate. (p. 369)

This means that ESP tests are based on the understanding of three ESP qualities which are that context influences language use, that ESP is precise, and that “there is an interaction between specific purpose language and specific purpose background knowledge” (Paltridge & Starfield, 2013, p. 368). With this in mind, ESP tests have the advantage that they are typically direct, authentic, and highly contextualized (Bailey & Curtis, 2015, p. 251) specially because “evaluation in ESP situations is concerned with the effectiveness and efficiency of learning” (Dudley-Evans & St. John, 1998, p. 129). This chapter will provide information about formal and informal assessment for the ESP course for mechanical engineers as well as the role of summative, authentic, and formative assessment.

Informal Assessment

Informal assessment can be evidenced in a language class in many ways. As Brown (2004) points out, “informal assessment can take a number of forms, starting with incidental, unplanned comments and responses, along with coaching and other impromptu feedback to the student” (p. 5). Thus, our roles as instructors will require us to be constant monitors to take advantage of the moments where informal assessment can happen. With that same idea in mind, the syllabus for the mechanical engineering course has been designed in a way that students will encounter plenty of in-class opportunities to communicate. As a result, this will create chances for students to get input on what is being done correctly and on what needs improvement through informal assessment. However, this type of assessment goes beyond saying “good job” or “do we say *is* or *are*?” (Brown, 2004, p. 5). The same author points out that “a good deal of a teacher’s informal assessment is embedded in classroom tasks designed to elicit performance without recording results and making fixed judgements about a student’s competence” (Brown, 2004, p. 5). An example of this can be reflected on writing comments on a paper, providing recommendations on how to better pronounce a word, or suggesting the implementation of a strategy to compensate for a reading difficulty (Brown, 2004, p. 6). To summarize, informal assessment will be an ongoing task to be performed by the instructors of this course in order to fully maximize the opportunities for learners to follow up on their progress on a daily basis, contributing to a rich formative assessment in the class. The latter, thus, becomes a key concept to sustain the informal assessment strategies already mentioned. As Brown (2004) says, formative assessment consists of "evaluating students in the process of 'forming' their competencies and skills with the goal of helping them to continue that growth process" (p. 6).

Formal Assessment

On the other hand, formal assessment helps instructors identify the students' performance in specific tasks. Brown (2004), describes formal assessment as "exercises or procedures specifically designed to tap into a storehouse of skills and knowledge" (p. 6), in the sense of connecting the skills the students are supposed to acquire with what they actually know. Also, formal assessments "are systematic, planned sampling techniques constructed to give teachers and students an appraisal of students achievements" (Brown, 2014, p. 6). In that sense, the selected formal assessments must be planned in advance and must fit with the goals of the course, together with the selection of instruments and techniques that will help instructors to recognize students' lacks and improvement based on their performance. For this course, we incorporated different formal assessments to evaluate the students in reading, writing, listening and speaking. These assessments will be summative assessments, which according to Brown (2004), aim "to measure, or summarize what a student has grasped, and typically occurs at the end of a course or unit of instruction" (p. 6). Each assessment is planned to help instructors to recognize the students' progress on the studied contents. See table 4 for details and percentages of each of the assessments of the ESP course for mechanical engineers.

Table 4.

Evaluation of ESP course

Task	Percentage
Reading and vocab test	20%
Lab report (intro)	10%
E-mail	15%
Grammar quiz	10%
Listening quiz	10%
Project progress report	10%
Project oral presentation	15%
In-class tasks portfolio	10%

Reading and Vocabulary Test

The needs analysis results pointed out the students' need to read and understand different types of specific texts, and the diagnostic test administered reflected the students' lacks in terms of reading. Based on this, the first unit of the course included the necessary elements to help students to improve their performance by reading mechanical engineering texts to work on skills such as getting meaning from context, skimming and scanning to understand technical vocabulary, identify main ideas, and explain the information provided in the text. The reading and vocabulary test will be a formal summative assessment that will help instructors recognize the students' improvement in those skills. Coombe, Folse, and Hubley (2007) state that, "the best way to develop good reading assessments is to constantly watch for appropriate material" (p. 50), which means to use the most suitable material for the course and in the assessments. Thus, this test will be composed by different texts such as sections of manuals and segments of scientific articles. They will be real life texts that the population uses on a daily basis. Also, the texts will include items that will allow the assessment of the skills mentioned. In summary, the aim of this test is to assess students' ability to recognize general vocabulary related to mechanical engineering, to interpret meaning from context, to identify the main idea of a text, and to demonstrate comprehension of a text by reacting to it, using real life texts.

Lab report introduction

Students of mechanical engineering and mechanical engineers have to write extensive, detailed, and sectioned lab reports. Both students and stakeholders confirmed that writing different types of reports is a common task for them. Thus, the second unit of the course develops writing as the main skill, and one of the main tasks concentrates on writing the introduction section of a lab report. Also, writing a lab report introduction will be one of the formal assessments for the course. This assessment will allow instructors to measure the extent to which students progressed in writing skills using specific grammatical structures and technical vocabulary. The aim of this assessment is to identify the students' ability to coherently write their ideas including the necessary elements and using technical terms correctly. The assessment focuses on the introduction of a lab report because it helps teachers recognize the students' performance in the skills mentioned above and because of time limitations, writing a complete report is unachievable.

E-mail Reply

The students and stakeholders, as part as the needs analysis, expressed that mechanical engineers write emails on a daily basis. This task must be performed carefully and accurately since specific errors in the texts can lead to misunderstandings that can cause serious inconveniences. This is the foundation for the second unit, which is based on helping students improve their writing skills. The assessment resembles real-life scenarios in which they will have to send emails to clients and superiors. The assessment consists of writing an email, and it will be divided into two activities. First, students create and turn in their email, and then they will exchange the email with a classmate so that they can reply to it.

Grammar Quiz

The diagnostic test showed the students' need to develop and improve specific grammatical elements such as passive voice, modals verbs, and imperatives. For the grammar quiz, the purpose is to measure the extent to which students are able to correctly use those elements when communicating in real-life situations that will be studied in the course. This assessment will happen towards the end of the course in order to assess the grammar covered in all three units.

Listening Quiz

Listening was rated as one of the least needed skills for mechanical engineers. However, it is important in the process of developing better oral communication skills. Thus, a listening quiz will be a formal summative assessment in this course. The purpose is to identify to what extent students are able to understand the language in aural form, comprehending technical terms, and general mechanical information.

Project: Progress Report and Oral Presentation

Speaking was selected as one of the most wanted skills by the participants. Mechanical engineers will use this skill mostly to explain and describe specific processes or products to clients, superiors, and colleagues. In the diagnostic test, students had to perform a similar task. They had to describe a product, but with no previous preparation. In this project, students will have to carry out a similar task where they need to describe a product, but this time, having more time and resources to do it. This project has two phases. First, students hand in a progress report in written form, which consists of a draft of their final project. Second, students share their project orally. The project aims at measuring the progress students made throughout the course, including their ability to use technical terms and provide details when communicating in real-life contexts related to the mechanical engineering field.

In Class-task Portfolio

The last formative summative assessment is an in-class tasks portfolio. This is a commonly used task because “portfolios provide a multidimensional perspective on students’ growth over time” (O’Malley & Valdez, 1996, p. 35). They allow both instructors and students to keep a close record of the students’ improvement throughout the course. The purpose of this assessment is to help students keep a record of their progress, to be able to easily recall what is being studied, and allow them to keep an organized documentation of the studied contents in the course for future reference. This portfolio will be completed by including weekly specific entries based on tasks carried out in class.

Attendance

In this course, attendance will not have a percentage in the final grade. It will not be mandatory but with more than three absences, the student will not receive the university's certification for the course.

Assessment Instruments

The fact that ESP is accountable teaching has “produced a demand for more and better evaluation procedures” (Hutchinson & Waters, 1990, p. 144), and two levels of evaluation are mentioned by these two authors: learner assessment and course evaluation. Given the fact that “the ESP course exists to satisfy a particular learning educational need” (Hutchinson & Waters, 1990,

p. 152), we developed an assessment tool to evaluate the ESP course for mechanical engineers. This tool aims at making sure that the course is meeting the language needs of the learners because “evaluation helps to show how well the course is actually fulfilling the [educational] need” (Hutchinson & Waters, 1990, p. 152).

In order to make the necessary adjustments in the course, the ESP course assessment tool (See appendix O) aims at evaluating the course after each of the units has been finished and, therefore, use the collected data as “starting point for any necessary revisions of the course” (Hutchinson & Waters, 1990, p. 152). The reason behind choosing to evaluate the course after each unit lies in Hutchinson and Waters recommendation of evaluating the course “at regular intervals throughout the course” (2000, p. 155). Students are asked to assess the course in three different sections: 29 short statements divided into 12 statements for the content section, 8 statements for the materials section, and 9 for the activities section. In each section students need to indicate the frequency with which each statement is true for each of the units, and some of the statements in the content section are to be adapted in the evaluation form for each unit in order to measure the achievement of the unit objectives.

There are also three open-ended questions at the end of the form in order to collect more detailed feedback and insights for the student-teachers, considering that “any assessment should also provide positive feedback to inform teachers and learners about what is still not known, thus providing important input to the content and methods for future work" (Hutchinson & Waters, 1990, p. 151).

A tool was developed for students to evaluate the student-teachers' performance (See appendix P), and it contains 1 section with 13 statements in which, similarly to the course evaluation tool, students are requested to indicate the frequency with which the statements are true. This section is followed by two open-ended questions for students to provide more detailed feedback on the student-teacher's performance. The purpose of this tool is to gather information regarding the teaching, the student-teachers' performance and delivery, the implementation of classroom techniques, and the effectiveness of teaching practices in general. This tool also plays a social role "by showing the various parties involved. . . that their views are important" (Hutchinson & Waters, 1990, p. 152), so the responses provided by the learner will help the student-teachers make changes or adaptations in the course with the purpose of making learners' views relevant.

Considering that "as with any language course there is a need to assess students' performance at strategic points in the course" (Hutchinson & Waters, 1990, p. 144), we developed an assessment tool for unit 2 (See appendix Q). This tool focuses on writing a response to an email since one of the objectives for this unit states that students will be able to properly write inquiry emails to experts in mechanical engineering by following the format of sample emails provided.

Another reason for choosing and developing this tool is that "ESP is concerned with the ability to perform particular communicative tasks"

(Hutchinson & Waters, 1990, p. 144). This test is a combination between an achievement test and a proficiency test since as explained by Hutchinson and Waters (2000), the achievement test shows “how well the learner is keeping up with the syllabus” and the proficiency test assesses “whether or not the students can cope with the demands of a particular situation” (1990, p. 146). Green (2014) exemplifies a proficiency assessment as one in which “a user might wish to know whether an assessee has the language skills to write a technical report as an engineer” (p. 135) which somehow resembles this tool and others proposed in the syllabus.

To summarize, the assessment instruments previously explained aim at carefully measuring to what extent objectives were achieved through the course. Furthermore, they are expected to show evidence of how much progress students were able to make after attending the sessions designed to cater their needs in the field.

Chapter IV: Course Evaluation Report

This research project was developed simultaneously with the teaching practicum of the Master’s Program in TEFL at the University of Costa Rica with the purpose of exploring the outcomes of one element of the ESP course developed for mechanical engineering students from UCR. Even though there are many elements to be considered when assessing an ESP course, after validating the importance of speaking and writing in the students’ academic and professional context, the researchers focused on identifying students’ strengths and weaknesses in the productive skills assessments. In other words, they analyzed the results of the oral and written assessments based on rubrics and data collection tools developed for this purpose. The specific assessment tasks for writing were an email reply, a lab report introduction, and a project progress report. For speaking, the focus was a project oral presentation.

Research Question

This study intends to answer the following research question: What was the students' performance like in the assessment tasks of the productive skills in the ESP course for mechanical engineers?

Sub-questions

To determine the results of the research study, the following sub-questions will be addressed:

1. What were the students' strengths in the productive skills in each of the components evaluated?
2. What were the students' weaknesses and most common errors in the productive skills in each of the components evaluated?

The skills of writing and speaking play a very important role in both the academic and professional fields of mechanical engineers. Because of that and the nature of the practicum developed during the second semester, it is of great relevance for the researchers to explore the performance these students had when writing and speaking in English during the course.

In order to support this research study, the following review of the literature intends to analyze the theoretical background based on authoritative sources concerning the assessment of productive skills and particularly its applications in ESP given the nature of this research study. The first section of the review of the literature explores assessment of productive skills from a general perspective.

Secondly, the review delves into the assessment of productive skills within the CEFR framework, which was chosen due to the benefits it offers for assessment. The third section focuses on the assessment of writing and its approaches among other theoretical aspects, and it is focused on email writing, lab report writing, and technical report writing. Lastly, the review of the literature addresses the assessment of speaking with a focus on oral presentations of a project.

Review of the Literature

Assessing Productive Skills

Referring to the literature on productive skills in necessary before narrowing down to the assessment of speaking and writing. Celce-Murcia, Brinton, and Snow (2014) explain that students produce language and meaning when they speak and write, and that is why these two macro skills are called productive skills. One of the advantages of focusing on productive skills in the language classroom lies in the fact that language output can be observed, for example, in a piece of writing or in an oral response and thus, it can be measured. This cannot be done with receptive skills (Celce-Murcia, Brinton, & Snow, 2014).

Important differences between speaking and writing should be considered. Coombe, Folse, and Hubley (2007) define oral skills as being “part of a repertoire of routines for exchanging information or interacting, and improvisational skills such as negotiating meaning and managing the interaction” (p. 114). These same authors also contrast speaking with writing by indicating that speaking is more ephemeral than writing and, for this reason, they suggest recording students’ performance. On the other hand, Mihai and Purmensky (2016) define writing as “a productive skill that allows the language learner to communicate ideas using language represented through graphic symbols considered the more difficult of language skills to acquire” (p. 199). For the purpose of this research, understanding the differences between the two productive skills is essential to determine the choice of the construct of speaking and, therefore, these characteristics must be present in any speaking assessment (Coombe, Folse, & Hubley, 2007).

The developments in language theory have changed the focus given to language assessment. Subjectivity is one of the main concerns when grading writing and speaking assessments (Coombe et al., 2007), but fortunately, different types of assessment for productive skills reduce potential subjectivity. For instance, instead of discrete point tests of grammar and vocabulary, “tests of both speaking and writing were developed and procedures for determining the reliability of raters’ assessments of speech and writing samples were more routinely emphasized” (Bailey & Curtis, 2015, p. 125). This implies the development of clear oral assessment procedures for evaluators as well as clearly defined rubrics which all together along with triangulation reduce potential subjectivity when assessing productive skills.

One of the main reasons why assessment and its results are the focus for this research project is that they provide information about competence to support learning (Dudley-Evans, 2009). What is more, when assessment provides this support for learning, there are adjacent benefits such as confidence building and involvement (Dudley-Evans, 2009) which emerge from student and teacher motivation in the teaching and learning process. Identifying students' strengths and weaknesses in light of the assessment results based on the content covered during the course is precisely the ultimate goal of this research study considering that when ESP students perform successfully in their target situations, the ESP course can then be considered successful as well. However, it is important to keep in mind that all students are unique with their own strengths and weaknesses, which makes it unlikely for all students to obtain full marks (Dudley-Evans, 2009).

Exploring what assessment really is about becomes important at this point. Coombe et al. (2007) explain that assessment is not limited to tests as traditionally believed but "includes a broad range of activities and tasks that teachers use to evaluate student progress and growth on a daily basis" (p. xiii). These authors also make a clear distinction between assessment, testing, and evaluation despite the fact that testing and assessment are often used interchangeably. Coombe et al. (2007) also add that

> assessment is an umbrella term for all types of measures used to evaluate student progress. Tests are a subcategory of assessment. A test is a formal, systematic procedure used to gather information about students' behavior. In summary, evaluation includes the whole course or program, and information is collected from many sources including the learner. While assessment is related to the learner and his or her achievements, testing is a part of assessment and it measures learner achievement. (Coombe et al., 2007, p. xv)

Robinson (1991) simplifies the distinction between assessment and testing by stating that even though evaluation and testing are usually considered the same, testing is only a part of evaluation. As explained by Paltridge and Starfield (2014), “all language tests require the developers to define the purpose of the test, conduct a needs analysis, collect language use data in context, analyze target communicative tasks, and develop test tasks that reflect the target tasks” (p. 368). Similarly to general assessment, ESP assessment seeks to determine if a teaching program has been effective and efficient (Robinson, 1991) but has variations when compared with other areas of language teaching and learning. One distinction is how language skill and background knowledge are related to one another (Paltridge & Starfield, 2014). This distinction is explained by the authors based on three qualities of specific purpose language: “first, that language use varies in context, second, that specific language purpose is precise, and third, that there is an interaction between specific purpose language and specific purpose background knowledge” (p. 368). Similar views are shared by Robinson (1991) and Bailey and Curtis (2015). The former claims that background knowledge is affected by the comprehension of a text and the performance on a test. This poses test and assessment design implications that the researchers of this study should consider when developing and grading assessments. The author also suggests that for an ESP test to be valid, it should be based on the tasks that learners are required to perform in real life. In the same way Bailey and Curtis (2015) believe that ESP tests

> are derived from an analysis of a specific purpose target language use situation, so that test tasks and content are authentically representative of tasks in the target situation, allowing for an interaction between the test-

takers' language ability, and specific purpose content knowledge, on the one hand, and the test tasks on the other. (p. 249)

Douglas (2000) reinforces the authenticity feature of ESP tests by expressing that if a student's performance on a test will be considered as evidence of language ability in an ESP context, when taking a test the students should be involved in authentic tasks that resemble real life. Bailey and Curtis (2015) describe this same feature of language for specific purpose tests as a strength considering that these test tasks are characterized by being direct, authentic, and contextualized.

Robinson (1991), moreover, poses the challenge of ESP assessment in the fact that ESP students are expected to perform satisfactorily both at work and in college. All the previously mentioned specific language and content requirements create the need for real-life, authentic assessment tasks that resemble what has been taught but more importantly, what students will carry out in their academic and/or professional contexts. For this reason, a test for an ESP context requires language production and comprehension according to the demands of the specific purpose (Bailey & Curtis, 2015).

Bailey and Curtis (2015) additionally suggest that authenticity of task and the interaction between language knowledge and specific purpose content knowledge are two key issues in language for specific purposes test development, which differs from the development of more general language tests. They also define authentic tasks as those that contain the crucial characteristics of the learners' target situation. They highlight authentic assessment task features such as the resemblance of the task to the real-world conditions and the replication of learner abilities to perform accurately in this context.

In order to achieve the expected performance in written and oral assessment tasks, authors aim at carefully developed test prompts. Defined by Coombe et al. (2007) as “the stimulus the student must respond to” (p. 72), prompts need to be correctly built by test developers considering that depending on the context, lives can be put at risk if language ability interferes with the appropriate management of an ESP task (Bailey & Curtis, 2015). The same happens in mechanical engineering when human lives could be put at risk if equipment is used incorrectly, for example.

Since this research study is based on assessment and its results, literature about types of tests was reviewed. Most literature describes the difference between progress tests and achievement tests in a similar way. Coombe et al. (2007) indicate, for instance, that in general terms progress tests “provide information about mastery or difficulty with course materials” (p. xxi) and “measure the progress that students are making toward defined course or program goals” (p. xvii). Contrastively, achievement tests provide information about students’ attainment of course outcomes at the end of a course or within the program (Coombe et al., 2007, p. xvii). For these authors the main difference between progress tests and achievement tests is that progress tests are produced by teachers focusing on the assessment of fewer objectives and less content, whereas achievement tests usually assess all the content of the course in a comprehensive, cumulative manner. This information is highly relevant for this research in order to analyze results in the light of the different types of tests used for data collection.

Effective assessments need scoring that produces results which contribute to rater-reliability and positive washback, among others. Washback, defined by Dudley-Evans (2009) as "the effect that a test has in what and how students are taught" (p. 214), is crucial to be considered in assessment. Consequently, all tests should be designed with the purpose of obtaining positive washback as advised by Dudley-Evans (2009). As explained by Celce-Murcia et al. (2014),

> once students move away from more controlled language production and begin generating extended texts either in spoken or written performances, teachers are faced with the problem of how to capture and make sense of the language that students are generating. In addition to the assessment task itself, for example producing a paragraph or engaging in a debate, a consistent means of scoring student performances is needed. (p. 328)

The need for washback and scoring is similarly encountered in one of Bailey and Curtis' (2015) principles for designing communicative language tests. Their fourth principle claims that assessment procedures should promote positive washback, which entails the development of precise scoring criteria that students can have access to. This takes the review of literature to an equally important aspect of assessment: scales for scoring. McNamara (2017) claims that

> the wording of rating scales may vary according to the purposes for which they are to be used. On the one hand, scales are used to guide and constrain the behavior of raters, and on the other, they are used to report the outcome of a rating process to score users. (p. 42)

Considering that this study focuses on assessment, rating scales have a crucial role in data collection, rater reliability, and data analysis. In order to associate a qualitative measure with the varied aspects of the assessment tasks, analytic rubrics, a type of rating scale, can be used. Analytic rubrics, which were designed and used as part of the data collection instruments for this research study, classify different language performance elements and assign individual scores for each element (Celce-Murcia, Brinton, & Snow, 2014) while hypothetically determining constructs for each skill (Bailey & Curtis, 2015). An analytic score "might assign a higher score to one factor, such as organization, and a lower score to another, such as mechanics" (Mihai & Purmensky, 2016, p. 223). Even though this type of scoring can be more time consuming, it also aids the teacher in the identification of individual issues and, therefore, contributes to more valuable and plentiful feedback (Mihai & Purmensky, 2016). As a result, focusing on a "number of specifically defined criteria comprising the total score might yield a more precise estimate and more informative diagnosis . . . than would a global score" (Bailey & Curtis, 2015, p. 183).

There are well-known frameworks that offer flexible scales. However, in order to develop a flexible scale it is necessary to define levels of competence with illustrative descriptors (McNamara, 2017) such as CEFR. This framework for assessment allows raters to develop analytic scales and involves clear level descriptors.

Assessing Productive Skills Under the CEFR Framework

The Council of Europe through the creation of the Common European Framework of Reference for Languages has made numerous contributions to the development of language tests and syllabuses, among others. In this regard, North (2014) claims that the CEFR provides a

> common reference point for the elaboration of language syllabuses, curriculum guidelines, examinations and textbooks. . . [and that] the purpose was to contribute to reform, innovation and networking in order to improve the efficiency of language learning in the school system. (p. 9)

In a similar perspective Kantarctoglu and Papageorgiou (2012) state that this framework can serve as a useful tool for the development of language assessments in a classroom. The view of these authors and many others support the reason why the CEFR was chosen as the framework to align the assessment tools of this research study.

Developing written and oral assessments in a language class requires a significant amount of time and guidance. The CEFR offers this guidance to educators through its framework and is widely supported by several authors. Concerning this, "language teachers are continuously required to assess their students' oral and written performances in the classroom, and the CEFR offers a variety of oral and writing scales that can form the basis for comprehensive rating criteria" (Kantarctoglu & Papageorgiou, 2012, p. 86). Luoma (2004) also states that the CEFR intends to provide learners and educators with help to establish objectives for language learning as well as the necessary support to achieve them. Additionally, North (2014) claims that the intention is for users of the framework to incorporate activities, competences and proficiency indicators that match their specific contexts.

As mentioned before, many scales or rubrics to assess learners are created under the light of CEFR. Kantarctoglu and Papageorgiou (2012) point out that these scales have become very popular because they can concisely describe objectives that learners can achieve in the different levels of language proficiency. Another appealing characteristic that these scales have is that their descriptors "are always phrased positively, as they are intended to motivate learners by describing what they can do when they use the language, rather than what they cannot do" (Kantarctoglu & Papageorgiou, 2012, p. 85).

The previous theory leads to referring to particular criteria that tap into the area of language for a social purpose as named by North (2014). The author states that the CEFR sees "the learner as a social agent who needs to be able to perform certain actions in the language. . . and prioritize linguistic goals because they are necessary for meeting those communicative goals – not just because they exist" (p. 10). This is where the information provided in these criteria feeds the achievement of specific communicative goals that the group of mechanical engineers needs to comply with in both oral and written form using English at an academic and professional level. The information below will explain the criteria for both written and spoken production that are pertinent to this study and that are aligned to the latest updates of the can-do statements for productive skills.

First of all, according to the Council of Europe (2018), the CEFR contains two scales for written interaction which are named *correspondence and notes*, and *messages and forms*. There are important details about the can-do statements in these scales that are relevant for this study, and these statements are divided into the different CEFR levels. At a C1 level, for example, students are expected to formally express themselves with clarity and precision in personal correspondence through a flexible and effective use of the language. At a B2 level, students are able to follow up on issues of mutual interest as they maintain a relationship through personal correspondence using appropriate structures, register and conventions. Finally, at a B1 level in this scale, students are expected to write basic formal emails when making a complaint or requesting information or a particular action.

The next set of descriptors corresponds to the section of written production, which includes written reports, essays, and creative writing. According to the Council of Europe (2018), “written reports and essays cover more formal types of transactional and evaluative writing” (p. 77). The Council of Europe (2018) states that at a C1 level, students are expected to write a longer report with an appropriate introduction and conclusion on a complex topic within their field of interest. At a B2 level, they are able to write a report that goes over an argument systematically by making emphasis on important points. Finally, concerning report writing, a B1 level of the CEFR is expected to write very brief reports by following a standard format where factual information and reasons for action are stated.

The third point regarding written production in this study addresses aspects related to writing a progress report on a project. In the same set of descriptors for written reports and essays, the Council of Europe (2018) states that C1 level students can write a longer report on a topic related to their field of interest. At a B2 level they can write a report that gives reasons and explains possible benefits and drawbacks of a specific issue. Finally, at a B1 level their written texts are shorter and use simple language to point out advantages and disadvantages and to give and explain an opinion on a topic of their interest.

The CEFR also offers communicative goals for speaking. In relation to production activities, “the categories for spoken production are organized in terms of three macro-functions. . . [which are] interpersonal, transactional, and evaluative" (Council of Europe, 2018, p. 69). Regarding interpersonal production, the CEFR refers to a section named *Sustained monologue: Giving information*. This "is a new scale concerned with explaining information to a recipient in a long turn; although the recipient may well interrupt to ask for repetition and clarification, the information is clearly unidirectional; it is not an exchange" (Council of Europe, 2018, p. 71). At a C1 level, the Council of Europe (2018) states that students are expected to deliver a clear and well-organized presentation on a complex topic and expand on supporting details by offering reasons and relevant examples. The sequence of their presentation is appropriate and allows the audience to follow it with no problem. At a B2 level, students can deliver a well-prepared and clear presentation by emphasizing important points and supporting details. Finally, at a B1 level, they should be able to deliver a prepared, straightforward presentation on a topic that is familiar to their field and pinpoint similarities and differences between products by developing a sequence that is easy to follow by the audience most of the time.

The next sections of this literature review deal with implications of assessing written and spoken language in an English class with an ESP focus.

Assessing Writing

The results of the needs analysis conducted for the development of the ESP syllabus for mechanical engineers revealed the need for writing in the academic and professional field of the students. Not only is writing important from the research participants' point of view, but Mihai and Purmensky (2016) also justify that depending on the assignment, it is necessary to enhance different styles of academic writing whether it is a paragraph or an essay. More specifically, “in the professional world, the ability to write resumes, cover letters, business letters, and emails can be critical to promotion and success” (Mihai & Purmensky, 2016, p. 199). Furthermore, writing assessment procedures must be thoughtfully chosen for the assessment process to be reliable and this process can become time consuming (Coombe et al., 2007).

Coombe et al. (2007) claim that universities and employers seek good writing skills and because of that these authors pinpoint the importance of assessing writing. Schaetzel, Peyton, and Fernández (2019) also support this noticeable importance of writing assessment by exemplifying that writing exams have become essential in the academic classroom context. Above all, “helping students learn the thought process for each stage of writing results in their being prepared not only for high-stakes writing exams, but also for the academic and professional writing they need to do” (Schaetzel, Peyton, & Fernández, 2019, p. 212). Additionally to the importance of assessing writing, the literature addresses varied perspectives and approaches on how to assess this macro skill.

Coombe et al. (2007) explain that indirect and direct assessment are two major approaches in assessment. Indirect assessment relies on multiple choice and cloze tests to assess spelling, punctuation, and sentence level constructions whereas direct assessment relies on the written production to assess the student’s ability to communicate. Direct writing assessment integrates all elements of writing such as content, organization of ideas, vocabulary, grammar, and syntax.

Assessing the product or the process is another distinction made in writing assessment. Nunan (1998) explains that the product approach aims at an accurate and coherent text free of errors. This text is the result of the imitation of a sample text provided by the teacher and used as a model by the students. The British Council (2019) describes this approach as traditional and outlines four stages for the model text presentation and analysis, which include highlighting of genre features, controlled practice of those features in isolation, organization of ideas and result. On the other hand, Ferris (2011) believes in the benefits of the process approach because by working on error correction students grasp complicated structures in the long term. Bailey and Curtis (2015) also see the benefits of process writing in that students not only focus on the outcome but also improve their final product during the writing with the implementation and development of strategies. Choosing one of the two approaches would depend on the course objectives, but Coombe et al. (2007) suggest combining both when assessing writing. They state that

> some writing tests assess the whole writing process, from brainstorming activities to the final draft or finished product. In using this process approach, students usually have to submit their work in a portfolio that includes all draft material. A more traditional way to assess writing is through a product approach. This is usually accomplished through a timed essay at the middle or end-point of the semester. (p. 75)

A third type of writing approach that relates to assessment is discussed by Celce-Murcia et al. (2014), who explain that writing (and speaking) assessments can have integrated or independent tasks. In integrated assessment tasks, students read and/or listen before responding to a question. In an independent assessment, students write or speak in response to a prompt. Recommendations in this regard include that the prompt or the input for the writing task be given mainly in non-verbal formats especially in EAP tests while EOP usually combines reading and writing considering that in this context many work situations require employees to first read a document to respond to it instantly (Dudley-Evans, 2009).

Certainly, literature on writing assessment is not limited to the previously mentioned points of view, and Coombe et al. (2007) propose two writing techniques that could determine how a writing assignment is assessed. One of the techniques is guided writing in which students are usually given a chart or diagram with content to be manipulated. On the other hand, in free writing students are expected to combine background knowledge and course content to write a response to a prompt with a situation (Coombe et al., 2007). In the particular case of free writing assessment, these authors recommend involving multiple raters when grading the written work, adapting rating scales to the task, and using the scoring criteria before the test so that students are familiar with it in advance.

Careful selection and planning of the prompt is central in writing assessment. A good prompt that establishes the writing objective is needed for proper argument writing and support (Schaetzel, Peyton, & Fernández, 2019). Several authors highlight the relevance of well-written prompts as well as characteristics of different types of prompts. Celce-Murcia et al. (2014) claim that prompt and scoring criteria are the two components of writing assessments. The prompt is particularly important because it establishes the task. Furthermore, the stimulus of a writing assessment is not restricted to writing only. Speaking, listening, or reading can serve as the stimulus for a writing assessment as well as any combination of all three (Celce-Murcia, 2008).

Davidson and Lloyd (as cited in Coombe et al., 2007), provide a detailed list of criteria for good writing prompts that include elements such as type of genre, degree of problem-solving, authenticity, and context specificity among others. Coombe et al. (2007) specify that prompts can be text-based, framed, or base prompts. Framed prompts pose a situation to be interpreted while base prompts simply present the information directly. Finally, coinciding with the type of prompts used in the data collection instruments for this research study, “text-based prompts provide a text for students to respond to in written form (Coombe et al., 2007, p. 72).

Using written texts and readings as prompts is widely supported. Schaetzel et al. (2019) suggest using read-to-write tasks for assessing writing and breaking down the process of answering the test question into three stages: analyzing the prompt, reading the text, and writing the response. Given the fact that ESP classes usually use readings for writing in their curriculum, readings become very useful for the writing class (Celce-Murcia, 2008) and, therefore, in assessment. Celce-Murcia (2008) claims that there is proof that professors assign readings for students to analyze and synthesize in a writing task such as in a lab report. Paltridge and Starfield (2014) emphasize that most writing assessments in a study conducted in engineering courses were either lab or design reports. Similarly, Celce-Murcia (2008) describes that lab reports are a common genre in academic writing and that this type of assignment is commonly preceded by a reading prompt as the basis in order to practice skills such as summarizing, interpreting, and paraphrasing. These strategies are essential for writing a lab report introduction as well as considering how to make the introduction clear, interesting, and appropriate for the context

(Dudley-Evans, 2009). Moreover, Mussman (2013) acknowledges the importance of the Introduction, Method, Results, and Discussion (IMRaD) approach for lab report writing and for typical moves and their functions in an abstract.

Another writing assessment in this study was an email response. As explained by Paltridge and Starfield (2014), specific writing instruction is required today by the workplace and universities, so ESP courses should meet the demands of these different contexts and, therefore, electronic writing should be addressed as well. The fact that abundant research has focused on email and its extensive use in the business world has also had an impact on assessment needs in the ESP classroom. One reason for this is that a company's prestige and an employee's successful business relationships can depend on a well-written email as illustrated by Chan & Frendo (2014).

However, integrating technology for this type of assessment offers drawbacks as well and could affect writing assessment negatively. As Coombe et al. (2007) point out, there is a high risk of using tools such as a grammar checker or a dictionary when using a computer for writing assessment. This would affect the reliability and validity of a writing assessment.

To conclude with this section, aspects in relation to error correction and feedback on writing assessments were considered. Ferris (2011) indicates that for feedback to be effective teachers should first teach the specific aspects to later refer to them for error feedback and correction always keeping in mind the expected response. Coombe et al. (2007) define the expected response as a description of what the teacher expects the students to produce in the writing task. Hence, it is optimal for the teacher to be clear about what the expected response of the assessment task should be before communicating it to students (Coombe et al., 2007).

When responding to student writing assessment, a popular technique teachers usually use to provide feedback is writing comments and codes in the margins of the papers for students to improve and correct the mistakes (Coombe et al., 2007). This is precisely what Ferris (2011) describes as indirect error feedback in contrast to direct error feedback. In the latter, the teacher makes the corrections while in indirect error feedback the teacher indicates that there is an error but the student has to make the correction on his own through analysis and reflection. Moreover, aspects dealt with in class such as grammar, morphology, lexicon, and mechanics should be the target of error correction feedback (Ferris, 2011). Assessment of speaking will be explored in the following section.

Assessing Speaking

The results of the needs analysis revealed the want from students to include speaking in their ESP course because of its importance in their professional field. Luoma (2004) states that the command of spoken skills is an important aspect of the curriculum when it comes to teaching a language, and so is their assessment. Furthermore, Coombe et al. (2007) say that “with English now a global language, a large percentage of the world’s language learners study English in order to develop proficiency in speaking” (p. 113). As a result, the way the students’ progress is tested and measured is directly linked to the creation of effective assessments in speaking that can allow reaching objectivity while evaluating this skill. In this perspective, Luoma (2004) claims that “assessing speaking is challenging . . . because there are so many factors that influence our impression of how well someone can speak a language, and because we expect test scores to be accurate, just, and appropriate for our purpose" (p. 1). Thus, giving accurate test scores to students is directly connected to how the assessment tasks are designed.

Regarding the previous concern, the concept of alternative assessment plays an important role in the design of effective assessment tasks for spoken language. As Herman, Aschbacher, and Winters (1992) point out, the implementation of alternative assessments allows students to move from choosing a unique correct answer to the exploration of possibilities in question items that are open-ended and that challenge them to make inferences to provide a response. For that reason, when it comes to assessing speaking, students need to be challenged in a way that they are able to elaborate and go further in their utterances, which will allow their language teachers to offer a better rating of their spoken skills. In addition to this, if students are provided with alternative assessments, they will encounter tasks that "tap higher-level thinking and problem-solving skills, invoke real world applications, and ask students to perform, create, produce or do something" (Herman, Aschbacher, & Winters, 1992, p. 6). Of course, all of the above contributes to the development of the four macro-skills, but seeing those implications through the lens of mastering spoken language adds more relevance to the appropriate design of speaking assessments.

Deciding how to properly design a speaking assessment task also involves choosing the right context. Luoma (2004) offers an accurate explanation for the context of a task and pinpoints that it "includes concrete aspects of the situation such as the place where the talk happens, and cognitive and experiential aspects such as the language use experiences that the speakers bring to the situation and the goals they have" (p. 30). In other words, the context has to be clear enough to guide students towards the production of language that can show the mastery of the skills and content learned; if context is clear in the assessment task, the achievement of objectives can become more visible and measurable.

In addition to this, speaking assessments need to have a clear objective for students to measure if they are performing appropriately in spoken language as they would be expected to do in real life. Concerning this point, Luoma (2004) explains that formal, real-life assessment tasks put students in a role that connects to their professional life and makes examiners take the role of customers or any other people with whom the examinee is likely to interact. Therefore, the scenario in which students are orally assessed has to be real-life oriented and should promote achievement of specific speaking objectives by resembling situations from the real world that they need to successfully deal with.

In addition to the aspects mentioned above, selecting the exact aspects of language itself that will be assessed in speaking has a direct connection with the type of oral assessment that is carried out by students. This means that depending on the type of transaction that is executed, the evaluation criteria vary. Coombe et al. (2007) claim that grammar, vocabulary, pronunciation, intonation, and content are the recommended constructs if the aim is to give an equal emphasis on fluency and accuracy.

Properly delivering an oral presentation is a very important aspect of spoken language to be mastered by learners, and mechanical engineering students are not the exception. When it comes to presenting in front of an audience, "the candidate is expected to give a short talk on a topic which he has either been asked to prepare beforehand or has been informed of shortly before the test" (Weir, 1990, p. 75). Concerning the features of oral presentations in ESP, Dudley-Evans and St John (1998) suggest that "an effective oral presentation is built on language and skills and requires confidence" (p. 112). This means that students should become fully aware of their delivery skills, since standing in front of an audience requires much more preparation. In this regard, Coombe et al. (2007) say that oral presentations also require students to monitor their delivery in terms of facial expressions, eye contact with the audience, and appropriate use of body language and gestures. This is highly relevant if analyzed from the ESP lens. In fact, Dudley-Evans and St John (1998) pinpoint that "oral presentations feature particularly on courses for. . . professional people such as doctors and engineers" (p. 112), which is also sustained by the data provided by stakeholders in the needs analysis carried during the initial stages of this research.

As of what exactly to elaborate on in an oral presentation, Celce-Murcia et al. (2014) claim that "topics for presentations will vary depending on proficiency level and the particular focus of the class, but in any case, students should be given some leeway in determining the content of their talks" (p. 113). The authors also support the idea of the teacher providing the structures and guidelines of the presentation. This was fully incorporated in the speaking assessment of this research since the students had to describe a product, project, or process in particular, but it was up to them which one to talk about.

A useful feature of oral presentations is that they can allow testers to measure a student's communicative competence. In regard to this, Mihai and

Purmensky (2016) point out that for students to achieve the goal of communication, production of their own needs to be evidenced when delivering a presentation in front of an audience. Luoma (2004) contributes to this with the concept of idea units and explains that

> the grammar or these strings of idea units is simpler than that of the written language with its long sentences and dependent and subordinate clauses. This is because speakers are trying to communicate ideas that listeners need to comprehend in real time, as they are being spoken, and this means working within the parameters of the speakers' and listeners' working memory. (p. 12)

Here is when the delivery of an oral presentation should not be perceived as a passive speaking assessment for the audience in the classroom. There is still the general misconception that oral presentations can be boring for listeners, and here is where language instructors need to get the audience involved. Celce-Murcia et al. (2014) claim that

> presentations can be frightening for the speaker and, after a while, boring for the listeners, so it is a good idea to ensure that the listeners take on some responsibilities during the presentation. This is an excellent opportunity for peer evaluation, guided by evaluative criteria that the teacher, the students, or both develop. These criteria should be put into a written form that guides the listening. At the end of the presentation, the evaluators can be asked to summarize content, note strengths and weaknesses, or relate the presentation topic to personal experience. (p. 113)

As pointed out by the authors, oral presentations should not restrict the audience from getting involved. Instead, they should allow for more feedback to be shared from student to student. Johnson (2013) supports this view by saying that having students assess their partners gives them an important responsibility for their peers' progress and also makes them focus on how they will manage those skills when delivering their own presentations. This was brought to discussion in this review of the literature because the students who took part in this project were exposed to peer assessment in order to benefit from its advantages.

The Method

In order to provide answers to the main research questions, this research study was conducted following a mixed-methods research (MMR) approach for data collection and, therefore, includes quantitative as well as qualitative data. Dörnyei (2007) states that "a mixed methods study involves the collection or analysis of both quantitative and qualitative data in a single study with some attempts to integrate the two approaches at one or more stages of the research process" (p. 163).

Instruments that provide data that can be counted or measured were used and, therefore, make this study quantitative. The quantitative data obtained from these instruments can be considered objective (Wallace, 1998) since it was displayed using figures, tables, and checklists. Moreover, the results were also analyzed in an interpretative fashion, which according to Dörnyei (2007), is the main characteristic of qualitative data analysis. Wallace (1998) describes this analysis of the information as subjective as it offers qualitative features to this study. In short, this study is quantitative because it included procedures for data collection that provide numerical information such as rubrics and instruments that summarize group results in numerical data (Dörnyei, 2007). The study is also qualitative because it included procedures for data collection that provided information to be analyzed in open-ended, non-numerical, and non-statistical methods (Dörnyei, 2007) such as instruments that provide samples of students' errors and their frequency.

Combining elements from both quantitative and qualitative research allows researchers to obtain more reliable, valid results because as explained by Dörnyei (2011) "qualitative and quantitative methods are used to measure overlapping but also different facets of a phenomenon, yielding an enriched understanding by illustrating, clarifying, or elaborating on certain aspects" (p. 164). Wallace (1998) also supports the interconnection that both approaches offer since "quantitative data can throw light on qualitative insights and vice versa" (p. 38).

Another benefit of using the MMR approach lies in the fact that "researchers who want to apply MMR need to plan and carry out their investigation with the goal of enhancing the mixed nature of the study and defending the quality and value of mixing both methods" (Brown, 2015, p. 79). This is another reason why the MMR approach was chosen for the purpose of this research study.

Context

The research was developed during one semester at the University of Costa Rica, public collage located in the urban area of San Pedro de Montes de Oca, specifically in the Engineering School as part of the practicum course for the Master's Program in TEFL of this public university. Students were neither charged for this course nor did they receive university credits for it because the researchers needed volunteer students to carry out their teaching practicum. The course was taught on Mondays from 5:00 to 7:30 pm during a semester for a total of 45 hours.

Participants

There was a variable number of participants throughout the study. The course started with 13 independent users of the language as determined through the diagnostic test and based on the CEFR. The group was made up of 11 male students and 2 female participants. They were chosen after completing the recruiting process and the diagnostic assessment designed during the first semester of 2019. However, only six male students finished the course and thus, only the data coming from these students were analyzed considering that they completed all the assessment tasks for the study. Any of the six students who finished the course had had any formal English training after high school.

From the seven students who dropped out, two stopped attending after the first two weeks of class, whereas the remaining five dropped out before the assessments in this study were carried out. The general age range of the six participants who finished the course is between 20 and 26, and all of them are full-time students with little or no work experience. All of the six students performed at an intermediate proficiency level in the diagnostic test conducted at the beginning of the course.

Data collection instruments

Rubrics

All the writing and speaking tasks that were used for this research study also served as summative and formative assessment of the ESP course for mechanical engineers. Detailed, analytic rubrics were developed for each of the writing (see appendixes Q, R, and S) and speaking (see appendix T) assessment tasks including constructs such as grammar, vocabulary, mechanics, organization, and task completion based on CEFR's descriptors for independent and proficient users of the language. In fact, Kantarctoglu & Papageorgiou, (2012), Luoma (2004), and North (2014) support the use of this framework for assessment purposes due to the many advantages and guidance it offers. The descriptors in the rubrics were adapted in order to match the specific requirements for the task in terms of achievement and expected language use, and they are followed by can-do statements to be tallied based on the assessment results of each student. The use of such can-do statements is also supported by Kantarctoglu & Papageorgiou (2012).

Also, as evidenced in the rubrics for the writing assessments (see appendixes Q, R, and S), it is important to mention that the possible scores students could obtain were 5, 3, and 1. If a student scored 3 points in all criteria, the grade would be a 6, in other words, a non-passing grade according to the indicator of strength for this study. This means that in terms of rubric design, obtaining a 3 is an indicator of weakness. The constructs for this score indicate that the student did not fully comply with what was expected in the task.

Additionally to the rubrics, specific data collection instruments were developed so that qualitative and quantitative data could be collected, analyzed, and processed in a systematic fashion. All the aspects included in these instruments are extracted from the syllabus, the content, and the language to be addressed for productive skills throughout the ESP course. The aspects in these instruments also refer to the constructs that are assessed in the rubrics with the intention of establishing a cohesive and coherent data collection process and analysis. Moreover, the structures and functions in the instruments were chosen based on their frequency in the authentic materials that these students are exposed to when in contact with the language. In the case of the writing tasks, the data collection instrument (see appendix Y) classifies the errors according to their type. For the speaking task, the data collection instrument (see appendix Z) allows researchers to do the same classification. Both instruments offer options for the researchers to use as a checklist and provide space to include comments on strengths and take notes of examples of the mistakes. Moreover, all options in the checklist are based on the contents covered in the course.

Two more instruments were developed with the purpose of summarizing the errors and displaying them as group results, and they are divided into group writing summary (see appendix AA) and group speaking summary (see appendix BB). These two instruments are identical to the instruments used for each student but contain the collective results of the group. A final instrument that contains the overall results for both speaking and writing was created (see appendix CC) with the purpose of quantifying the errors made by 50% or more of the students in both productive skills, as well as including qualitative information about the group's strengths in both productive skills. In short, data collection was achieved with seven tools including rubrics and data collection instruments.

The aim of the course in terms of grammar was not to teach the structures in isolation or make them the entire focus of the class. On the contrary, the aim was to teach certain structures linked to very specific uses as the tasks demanded

(Ellis, 2018), and based on what the students' proficiency allowed. Only particular elements from each grammatical aspect were taught, and this was done in direct connection with their meaning and use in particular engineering contexts, as suggested by Ellis (2018), who claims that there are techniques designed “to attract learners’ attention to form while they are using L2 as a tool for communicating” (p. 73).

The course writing and speaking assessments served two purposes since they measured the achievement of certain course objectives and at the same time provided data for this research study. Another significant reason why productive skills assessment was selected as the topic of this study is that the types of tasks developed are highly relevant in the workplace and could determine a mechanical engineer’s performance and affect an organization’s overall production. In addition, this research project sought to identify the most common errors in the previously mentioned assessments and, therefore, discover if the lessons had a positive effect on the acquisition of the content taught.

The following section describes each of the assessment tasks and refers to the rubrics and specific data collection instruments for each of the tasks. Instruments designed to appraise individual student performance are also described below as well as the instruments that summarize all of the group’s data per skill.

Assessment Tasks Description

Four tasks were developed throughout the course in order to assess productive skills. In regard to writing, students had to work on an email reply, a lab report introduction, and a project progress report. In the case of speaking, the task consisted of an oral presentation. All tasks are described in more detail in the following sections.

E-mail reply. Writing e-mails appropriately is part of the needs of mechanical engineering students in their field. As Chan and Frendo (2014) explain, well-written emails are important to keep successful business relationships in a company. Thus, the first writing assessment task attempted to measure to which extent students could properly write an e-mail reply. In this task, students were given a prompt consisting of an e-mail thread between a mechanical engineer and a supplier. Students took the role of clients and were asked to write a response to the quote for machine components by fully answering all the questions in the e-mail and adding comments as necessary (see Appendix Q).

Lab report. Another need that was pointed out by this cont in the needs analysis was the urge to properly write lab reports. As suggested by the Council of Europe (2018), attention was given to the reports section of the CEFR since the mechanical engineering students were expected to submit a lab report introduction as part of their assessments in the ESP course and in this research study. For the second writing task, students were given a lab report with the introduction missing. They were required to properly compose it by following the IMRaD (Introduction, Method, Results and Discussion) format and Mussman’s (2013) recommendations for lab report writing. As the IMRaD format suggests, they were expected to include background on the field needed to understand the text, a thesis statement, a hypothesis, the objective of the lab report, and finally the reason for conducting the research.

Project progress report. The third writing task consisted of a written progress report of the final oral project, in which students had to describe a mechanical engineering product or process of their creation. In this written report students were required to describe their project proposal, design, steps, and justification in a clear, detailed, and technical manner.

All three writing assessments (email, lab report introduction, and project progress report) were assessed through an analytic rubric based on the recommendations in Celce-Murcia, Brinton and Snow (2014), Bailey and Curtis (2015), and Mihai and Purmensky (2016). The rubrics included categories such as task completion, vocabulary, grammar, mechanics and organization (see appendixes U, V, and W).

Project oral presentation*.* At the end of the course students were required to give an oral presentation about a project designed and developed based on a topic of their choice. In this oral assessment task students were expected to incorporate input from all three units taught as needed. The choice of constructs for the development of the rubric to assess this task was focused on Coombe et al's. (2007) recommendations (see appendix X).

Students were also expected to properly incorporate public speaking and persuasion strategies. These were studied in the course because mechanical engineers have to use them when proposing a new project design to a client in a meeting or to supervisors and employees at work. The descriptors provided by the Council of Europe (2018) offered light for the assessment of the oral presentation in the ESP course for mechanical engineers, which is part of this research study under this framework of reference. The reason why this is the only speaking assessment task during the course lies in the fact that this macro skill emerged from the needs analysis as one of the least necessary skills for mechanical engineers in the academic context and at work. However, since this is the assessment that students carried out at the end of the course, the task allowed them to apply and integrate all course contents in a productive and meaningful manner. To conclude, speaking was assessed through analytic rubrics that were carefully designed for this purpose and that were aligned to CEFR descriptors in order to measure students' performance in terms of grammar, vocabulary, content, pronunciation, intonation, and fluency when delivering their oral presentations. Important aspects of delivery and communicative competence were considered in the speaking assessment as a way to comply with the recommendations in the literature as explained before.

Procedures

The assessment tasks were administered at different stages of the research study. The email-writing task was administered first, and students completed it in class in less than 40 minutes without using dictionaries or any other aid. The second writing assessment administered was the lab report introduction, followed by the project progress report, which were both written by students at home. These three writing assessment tasks were administered upon completion of unit 2, which focused on writing. On the other hand, the oral assessment task was completed by students during the last day of class once unit 3, which focused on speaking and listening, had been completed. The oral presentations were audio recorded with students' permission for later analysis and grading.

Both researchers collected data using the research tools and rubrics to grade the assessment tasks individually, and then the data and grades collected by each researcher from each student and each task were averaged using the corresponding instruments. In this way, the score and data collected for each student were carefully considered by both researchers before compiling the group results. There were minor differences in the scores given by each researcher in two tasks, but they did not affect the students' overall grades.

For the oral task, rubrics and research instruments were completed by each researcher individually based on the recordings of the oral presentations, and then individual results obtained by each researcher were put together and averaged using the corresponding instruments. There were no disagreements between the two raters in relation to passing or failing grades, and the scores of individual raters did not differ significantly. Finally, the group's overall results for both speaking and writing were entered into the corresponding instrument using the data and scores obtained from the group summary for each productive skill. The data was analyzed based on Dörnyei's (2007) principles of qualitative and quantitative data analysis. He describes *data transformation* as an analytical strategy used in mixed-methods research which integrates qualitative and quantitative data for statistical or thematic analysis. In order to achieve this, grades obtained in the four assessment tasks that are part of this study were analyzed individually using rubrics and checklists with can-do statements. The passing grade of all tasks was 7 out of a maximum of 10. Group results from both qualitative and quantitative analysis were then summarized and averaged in one single instrument for each of the two macro skills in order to obtain group results. Finally, the most common errors were identified and the most common strengths were grouped following Dörnyei's (2007) concept of *typology/category development.* He explains that one type of data is analyzed to later establish categories that are used to analyze the other type of data. In the case of this research study, for instance, qualitative data was collected on the type of errors made for each of the specifically chosen constructs of speaking and writing in order to identify common errors. This data was later used to quantitatively identify the percentage of students who made those mistakes.

Regarding data presentation, Dörnyei (2007) explains that quantitative reports are characterized by tables and figures described as "reader-friendly data presentation methods whereas qualitative reports are language-based and iterative" (p. 285). In light of this, the next section shows the results obtained in this research study.

Results

This research aimed to measure students' performance in the assessment of productive skills in their ESP course. As specified in the methods section, the information gathered was categorized into strengths and weaknesses. Thus, the results obtained in this regard will be explained based on the assessment tasks used for the study, and in the following order: e-mail reply, lab report introduction, project progress report, and oral presentation.

First, for the email reply assessment, the results revealed that all six students were able to obtain a grade of 7 or above. Obtaining this grade was set as an indicator of strength in their performance, meaning that all of them were able to comply with what was expected.

To elaborate on the previous information, one out of the six students obtained a grade of 10, two of them a grade of 9 or above, two others a grade of 8, and only one was given a grade of 7. For this writing assessment students were evaluated in terms of task completion, vocabulary, grammar, mechanics, and organization. Regarding the first criterion the results indicated that five students complied with all required elements, whereas one of them included the majority of the indicated aspects to compose the email. Second, in terms of vocabulary the results revealed that four out of six students included appropriate technical vocabulary and sequencers to connect their ideas. However, two out of six students lacked some of the necessary vocabulary to properly reply to the email, and sequencers were not correctly used. As a third point, half of the participants were able to use grammatical structures correctly, which allowed the reader to understand the text, whereas the other half made some mistakes that distracted the reader from understanding the email at some points. In terms of mechanics, the results revealed that only two out of six students complied with the requirements with only a few to no errors in punctuation, spelling, and capitalization. The other four students made some errors in the aspects mentioned; for example, there were some run-on sentences in their writings. Finally, regarding organization, all six students were able to follow a logical flow or sequence by including a clear salutation, response, conclusion, and closing. The detailed scoring for each criterion is summarized in Table 5.

Table 5

Students' score distribution per criterion in email reply task.

Score	Task Completion	Vocabulary	Grammar	Mechanics	Organization
5	5	4	3	2	6
3	1	2	3	4	0
1	0	0	0	0	0

Note. Numbers shown derive from points obtained by the 6 students in the task.

Each students' writing assignment was also analyzed in terms of more specific, CEFR-guided can-do statements for an independent and proficient level. In this regard, the results revealed that only two students wrote the email response at a proficient level since they were able to formally express themselves with clarity and precision through a flexible and effective use of language. The other four were able to perform at an independent level by writing formal emails with appropriate register, structures, and conventions pertinent to the context. They can also make a complaint and request action as well as use language fluently and effectively to give detailed information about any particular experience. Nevertheless, these four students made some mistakes which prevented their performance at a proficiency level according to the rubric descriptors.

Second, for the lab report introduction, the results revealed that all six students obtained a grade of 7 or above. Similar to the email writing assessment, this grade was set as an indicator of strength in their performance, meaning that all of them were able to comply with what was expected. More specifically, two students obtained a grade of 9 and the other four obtained a grade of 8.

In terms of task completion, only one student included ideas that were not fully developed whereas the remaining five included all elements requested and developed completely their ideas. The opposite happened in mechanics, in which only one student had a few to no errors in punctuation, spelling, and capitalization. The other five students made some mistakes in those aspects. (See appendix U). Grammar results for this assessment showed that four students made some mistakes in meaning and/or form whereas two students used precise grammar structures that were correct in meaning and/or form. In relation to vocabulary, only one out of the six students lacked some technical vocabulary or used sequencers incorrectly. Finally, for organization, all six students obtained all the points. The detailed scoring for each criterion is summarized in Table 6.

Table 6

Students' score distribution per criterion in the lab report introduction task.

Score	**Task Completion**	**Vocabulary**	**Grammar**	**Mechanics**	**Organization**
5	5	5	2	1	6
3	1	1	4	5	0
1	0	0	0	0	0

Note. Numbers shown derive from points obtained by the 6 students in the task.

Again, each students' writing assignment was analyzed in terms of more specific, CEFR-guided can-do statements for an independent and proficient level. In this regard, the results revealed that two students wrote the lab report introduction at an independent level, which means that they need reinforcement and improvement to be able to write a suitable introduction to a longer report, article or dissertation on a complex academic or professional topic. On the other hand, the remaining four students were able to perform at a proficient level, meaning that they can write a suitable introduction to a longer report, article or dissertation on a complex academic or professional topic

Finally, for the third and last writing assessment, which was the project progress report, the results revealed that five out of six students were able to obtain a grade of 7 or above, which overall indicates success in their performance and compliance with the expectations set for this particular writing assessment. There was only one student who was unable to reach the successful performance indicator established in this study and obtained a grade lower than 7. To elaborate on this matter, three out of the six mechanical engineering students obtained a grade of 9, whereas one obtained a grade of 8, another one a grade of 7, and finally there was only one student who obtained a grade of 6 or above.

As in the previous tasks, the students were assessed in terms of task completion, vocabulary, grammar, mechanics, and organization. In regard to the first criterion, the results revealed that only three of the students complied with all the requirements and fully developed the report by considering the indicated aspects to describe the product or process, whereas two of them included the majority of the aspects the report asked for, and only one submitted a report that addressed a few of these requirements. In regard to vocabulary, the results revealed that four out of six students included appropriate technical vocabulary related to machine parts, tools and new technologies, and demonstrated an appropriate use of sequencers and linking words; however, the remaining two students lacked some of these lexical items to support the development of their report and showed an incorrect use of sequencers and linking words. In terms of grammar, the results showed that only one student used precise grammar structures that were correct in meaning and/or form with no to a few mistakes that could distract the reader from understanding. On the other hand, the remaining five students presented some mistakes in meaning and/or form that distracted the reader from understanding at some points. In relation to mechanics, the results revealed that five of the students presented a few to no errors in punctuation, spelling and/or capitalization with absence of fragments and run-on sentences, whereas only one of them presented some mistakes in the aspects mentioned before. Finally, in terms of organization all six students developed a report that followed a logical flow of ideas that helped the reader to understand the text. The detailed scoring for each criterion is summarized in table 7.

Table 7

Students' score distribution per criterion in the project progress report task.

Score	**Task Completion**	**Vocabulary**	**Grammar**	**Mechanics**	**Organization**
5	3	4	1	5	6
3	2	2	5	1	0
1	1	0	0	0	0

Note. Numbers shown derive from points obtained by the 6 students in the task.

For this last writing assessment, students' performance was also analyzed in light of more specific, CEFR-guided can-do statements. The results revealed that three students performed at an independent level, meaning that they can write a text on a topic of interest by using simple language as they point out advantages and disadvantages and justify their opinions. They can also provide reasons for or against a particular point of view. The results showed that the other three students were able to perform at a proficient level, meaning that they were able to produce suitable introductions and conclusions to a longer text on a complex topic in an academic or professional field within their interests. The results indicated that their writing was clear and well-structured.

This research study also intended to measure students' performance in spoken English through an oral presentation. In this speaking assessment a grade of 7 or above was also set as the indicator of success in student performance. The results revealed that two out of six students obtained a grade of 9, whereas two of them obtained a grade of 8 and the other two a grade of 7.

During their oral assessment, this group of mechanical engineering students was assessed in terms of grammar, vocabulary, content, pronunciation and intonation, and fluency in a scale from 1 to 5, with 5 being the highest score. This scale contained frequency ranges which were used to assess students' performance in the task. In terms of grammar, the results showed that two students were able to express complex ideas with ease and successfully shift from one structure to another, whereas two of them did it most of the time and the other two occasionally. In terms of vocabulary, the results indicated that four students were able to use an appropriate range of vocabulary related to machine parts, tools, and new technologies most of the time. They were also able to use some linking words, antonyms, synonyms, and sequencers which were part of the course syllabus, but did not show a full command of these lexical items to elaborate on complex subject descriptions. The two remaining students were able to go beyond the use of vocabulary described before and made an appropriate use of sequencers, linking words, antonyms, and synonyms. In regard to how content was addressed, the results point out that five out of six students gave descriptions that were clear and detailed for the project and went beyond expectations. There was only one student who offered fairly clear descriptions most of the time but lacked detail. Interestingly, for the section on pronunciation and intonation, there were three marked divisions of student performance. Two of these students usually clearly pronounced –s endings, –ed endings in regular verbs in past and past participial form and made a clear distinction between the /i/ and /I/ sounds. Their intonation of –wh and yes/no questions was clear and natural and allowed the listener to fully understand the message. Moreover, two of the students usually produced correctly the intonation and pronunciation aspects explained before, and the other two did it sometimes. Finally, in regard to fluency the same pattern was present. The results showed that two out of six students delivered the speech effortlessly, with natural speech, and no hesitation or breakdowns, whereas two of them delivered a speech that was smooth but with a little hesitation leading to rephrasing and minor breakdowns. The remaining two students produced their message with some hesitation, therefore causing moderate breakdowns in communication. The details of the results of the speaking assessment are summarized in Table 8.

Table 8

Students' score distribution per criterion in the oral presentation task.

Score	Grammar	Vocabulary	Content	Pronunciation and intonation	Fluency
5	2	2	5	2	2
4	2	4	1	2	2
3	2	0	0	2	2
2	0	0	0	0	0
1	0	0	0	0	0

Note. Numbers shown derive from points obtained by the 6 students in the task.

After delivering their oral presentations, the students were also assessed in light of CEFR-guided, specific can-do statements. The results showed that four out of six students were able to perform at an independent level, which means that they can give a clear and prepared presentation on a familiar topic within their field and that can be followed without difficulty most of the time; they are also able to point out similarities and differences, advantages and disadvantages of several options, and give reasons in support or against a viewpoint. In contrast, the results revealed that only two students were able to perform at a proficient level according to CEFR. This means that they were able to deliver a presentation of a complex topic that was clear and well-structured. They were also able to expand and support points of view by providing reasons and relevant examples.

Discussion

The aim of this study was to investigate the performance of a group of mechanical engineers in the assessment tasks of the productive skills in the ESP course. In order to answer the research question, this section focuses on salient findings and their analysis regarding the students' strengths, weaknesses, and most common errors in both speaking and writing tasks.

Strengths in Writing Assessments

The results of the three writing assignments that students completed show that organization is a strength since all six students obtained all possible points in the rubric for organization as detailed in tables 6, 7, and 8. This is a relevant finding considering that organization of each type of writing subgenre was addressed and thoroughly taught and practiced during the course. The fact that students worked with several samples of emails as well as lab reports and their organization could be a reason why good scores were obtained in this aspect. Hence, it can be said that this goes with Nunan's (1998) product approach in writing, where the result is the imitation of a sample text. Another reason could be that students had background knowledge in the organization of these types of texts due to previous exposure and, therefore, this aspect was not a challenge in these tasks.

Vocabulary seems to be another strength. Even though the results are not as homogeneous in all three tasks as with organization, the lowest score for this aspect was 3 out of 5, and it was obtained only by two of the six students. This means that considering the three writing tasks altogether, the majority of the students obtained the maximum score for vocabulary and therefore performed similarly. These results are somehow expected given that there was constant and detailed vocabulary work throughout the course. Students were provided with complete glossaries in each lesson, which seems to have aided the incorporation of such lexicon in the assessment tasks.

With less consistency than organization and vocabulary, overall task completion results show that students were able to comply with all or nearly all that was expected from the task in terms of content and length. The outlier is a student who obtained a score of 1 because he wrote limite d content in one of the tasks. However, it can be deduced that there might be several factors that can cause students to write more or less. Familiarity with the topic, interest, test anxiety or mood are some examples of internal factors that could have caused variations in the scores for completion. Nevertheless, as mentioned before, task completion can be considered as a relative strength considering that the majority of the students obtained scores of 5.

Weaknesses in Writing Assessments

Grammar and mechanics are the two weakest constructs of writing as seen in the results obtained from the three writing tasks. Table 9 below summarizes and compares the results for grammar and mechanics in each writing task. Even though no students obtained the lowest score in any of the writing tasks for either grammar or mechanics, these two constructs are considered weaknesses since the majority of the students scored 3 points out of the 5 possible points. As mentioned before, obtaining 3 points means that the learner is unable to fully comply with the requirements of the assessment as there are areas of improvement to meet expectations. We can derive from the data in table 9 that overall, for grammar and mechanics the majority obtained 3 points while no student scored at 1 point in the writing assessment tasks. Moreover, there is a relevant exception in mechanics for task 3. In this writing task, which consisted of a project progress report, only one student did not score all maximum points. Further research could be conducted in order to identify possible reasons for these outlying results considering that the type of subgenre differs from the previous two tasks, and considering that writing task 3 was more of an informative nature compared to the first two writing tasks. It can be implied that given that writing task 3 was broader in nature, instruction about this type of task should have been more detailed or of a stronger focus than tasks 1 and 2 in order to provide students with all language requirements to be able to comply with the task more at ease.

Table 9

Number of students who obtained each score for grammar and mechanics in each writing task

		Score	
Grammar	**5**	**3**	**1**
Task 1	3	3	0
Task 2	2	4	0
Task 3	1	5	0
Mechanics	**5**	**3**	**1**
Task 1	2	4	0
Task 2	1	5	0
Task 3	5	1	0

Note. Numbers shown derive from points obtained by the 6 students in the task.

Despite the fact that in task 3 most students scored positively in mechanics, opposite results were obtained for grammar. In this same task, five students obtained a score of 3 out of 5 leaving only one student with the maximum score. This is relevant for the study because it is another contrastive result in the same task. A possible explanation for these results could lie in the fact that this writing task offered the students more flexibility in terms of content. For the previous two, students were given the prompt (in the case of the email they had to reply) and the complete lab report (which they had to write the introduction for). On the contrary, the project they developed for which they had to write the progress report (writing task # 3) was open to a topic of their choice and, therefore, the low restriction of content and the need for the inclusion of students' personal opinions could have caused students to make more grammar mistakes. In this case further research is recommended on the development of project reports for this population of mechanical engineers in order to determine whether the type of writing task had an effect on the type of language needed from students or on the level of challenge of grammar structures required. This could also be linked to focused instruction of the language for tasks 1 and 2, but not of that for task 3 given its broader nature.

This study also aimed at identifying the most common mistakes students made. For the writing tasks, the most common grammar mistakes included passive voice errors, word order, and subject-verb agreement. Table 10 provides examples of each type of mistake taken from the students' writing tasks.

It is interesting to notice that even though passive voice was thoroughly taught throughout the course, the students made several mistakes with this structure. The fact that the writing tasks demanded the use of several tenses, active voice, passive voice, and complex grammar constructions at once might have hindered the accurate use of passive voice when in context and in combination with other structures. Most of the mistakes in this regard relate to the use of a verb in simple form instead of the past participle form. This somehow evidences students' awareness of the use and meaning of passive voice since all the errors of this type were found in the right environment for passive voice to be used.

Table 10

Samples of the three most common mistakes in students' writing assessments in grammar and mechanics

	Grammar	
Passive voice	-this can be facilitate -it couldn't be send	-it is successfully proof -their performance is measure
Word order	-the objective is to know how works a heat pump -to obtain the information necessary for this	-the coefficient of performance usually is more - it will be necessary smaller arrays
Subject-verb agreement	-the heat pump have -figure 1 and 2 illustrates	-a parameters is shown -we was talking about
	Mechanics	
Spelling	-trough -saourronding	-wich -obteined
Punctuation	-Thanks for your response, I was waiting for it. -Please, let me know if, you can send it.	-It is used in homes there is great potential.
Capitalization	-Figure 2 shows a Heat pump cycle. -We need to discover How it works.	-…is powered by direct solar panels, The goal is to…

Note. Punctuation and capitalization rules were not explicitly taught in the course.

Another common grammatical error found in the writing tasks is word order. This type of error was commonly found in both statements and questions especially in simple present tense utterances both in active and passive voice. This observation is unanticipated considering that the students performed at an independent level of proficiency in the diagnostic test; and considering that they were exposed to more complex structures during the course. Some errors with the passive could also be normal at independent level. Nevertheless, students could have been exposed to the form of simple present tense at early stages of their learning process, suggesting that the correct structure was latent. The third most common grammatical error found was subject verb agreement. In most cases, this type of error was found in utterances containing long or compound subjects and, suggesting that it is easier for students to lose track of the referent in the sentence causing disparity in the choice of verb number. Similarly to the previous type of error, this one seems to be a basic aspect of the language that students should be mastering at this point. Further research, if conducted, could determine the root cause of these issues and could contribute to identify adjustments that could be made in the course for this aspect to be reinforced if retaught.

The weakest aspect of mechanics that was identified in the writing tasks is punctuation, and precisely one of the limitations in this study relates to the insufficient amount of time to focus on mechanics during the ESP course. This is reflected in students' performance in the writing assessment tasks since there are several errors that relate to basic punctuation rules. Run on sentences, comma splices, and fragments were commonly found even though students were given a writing aid with punctuation rules. If they had been exposed to punctuation practice with greater frequency and time, perhaps students' proficiency in this regard would have been higher. Follow up research could determine if the suggested exposure can generate improvements or if different teaching methods were necessary. It can be enlightening to look into students' punctuation proficiency and familiarity in their L1 in order to determine if their weakness is directly connected to English or if it goes beyond to their L1.

Before discussing results for the oral assessment, we summarize that students' overall performance in writing assignments was at an independent level and that their strengths are organization, task completion, and vocabulary while the weaknesses are limited to specific aspects of grammar and mechanics.

Strengths in Oral Assessments

The results of the project oral presentation revealed that content is a strength since five out of six students obtained all possible points in the rubric. The relevance of this finding lies in the fact that this group of students was highly encouraged to work on detailed descriptions because of the importance this has in the workplace. During the course, they were also asked to submit a written report on the progress of their project, so this could be a reason why they carried out a deeper research on their topic to later deliver a complete oral presentation. Another reason could be that throughout their major they are also encouraged to go beyond expectations by providing detailed descriptions on particular subject matters. The lowest score in this construct was 4, meaning that this student was very close to meeting the expectations for the presentation in terms of content.

Similarly, the results show that overall command of vocabulary was good and consistent in the group of students. The highest score they could obtain was a

5, and two of the students achieved that number of points. The other four obtained a score of 4, which means that most of the time they showed correct application of the lexicon studied throughout the course. Just as it happened in the writing assessments, the glossaries designed throughout the course seem to have contributed to the incorporation of relevant lexicon in the oral presentations. These results shed light on the importance of strongly addressing vocabulary in an ESP course since this is one of the aspects many students may struggle the most with. For this particular course this need was clearly pointed out by the participants.

In terms of pronunciation, there is significant evidence of strength in how students pronounced –ed endings in their presentations; in fact, only the words "invested" and "trapped" were mispronounced by one student. The rest managed the pronunciation of these endings very well. It can be said that the course allowed for growth in this regard since students had a significant exposure to this when the topic of passive voice was covered in class. The opportunities for oral practice and timely feedback may have been significant factors which allowed for a positive salient performance in this regard. Thus, in a future ESP course for this population this is a pronunciation aspect that should remain as part of the syllabus due to the improvement students showed in the pronunciation of the –ed endings in this study.

In regard to the can-do statements, the strengths identified are that most of the students, specifically four of them, were able to perform at an independent level as they are able to deliver a presentation that is prepared, straightforward, and systematically developed. For this particular research paper, the can-do tables from CEFR were adapted in a way that they could display the descriptors that were pertinent to this study, and that allowed the researchers to say that their performance matches to a significant extent the profile of an independent user of the language. For the other two students, the evidence of their performance allows the researchers to place them under the umbrella of proficient users of the language based on the descriptors pertinent to this research because the delivery of their speech highly matches with the can-do statements for a speaker with said proficiency profile. There was an evidenced improvement in performance from the diagnostic test principally observed in the appropriate use of some technical vocabulary taught during the course and in the accuracy of some grammatical structures also taught during the course.

Weaknesses in Oral Assessments

Grammar and the pronunciation of vocabulary words related to machine parts, tools, and new technologies are the two weakest constructs of speaking for the participants in this study. It can be derived from the data obtained that a higher focus on pronunciation practice was needed in the course. Despite the fact that students had a lot of exposure to glossaries to improve their reading and writing, the length of the vocabulary lists and little time devoted to pronunciation practice of these words in the course may have been the reasons why most of the students did not fulfill expectations in this matter. It should be said, however, that the low exposure to spoken English was limited by the need for focusing more on reading and writing due to the nature of the major as identified in the needs analysis conducted in early stages of this research. Further research can be done on the internalization of the correct pronunciation of technical words and their use in major oral transactions of students of this area. Table 11 shows samples of words that were presented in the glossaries and that were mispronounced by the students.

Table 11

Sample vocabulary items related to machine parts, tools, and new technologies that were mispronounced in the oral presentations

Nouns	**Verbs**	**Adjectives**
Power, wire, conductor, maintenance, gears, strengthen, bearings, manufacturing, fins	turn	efficient

In regard to grammar, it can be said that for students who got the lower scores, it was somehow challenging to manage the idea units that Luoma (2004) talks about, meaning that they encountered some difficulties to communicate complete ideas that the audience could comprehend in real time. Other factors that might have contributed to getting these scores could be anxiety and nervousness at the moment of standing in front of an audience and being assessed as Celce-Murcia (2014) pointed out.

Another aspect that needs to be discussed in terms of grammar is related to the type of mistakes that were made by students. The first two objectives of unit 1 addressed the use of simple present in active and passive voice, and the group of students had exposure to this grammar during three consecutive lessons; however, the results reveal that the majority of the students made significant mistakes in the use of simple present in active voice. Something that might have led to this is the fact that the exposure to this grammar was done through reading and writing exercises because of the focus given to the course at the beginning. Concerning the use of simple present in passive voice the results reveal that only a small number of mistakes was made by students. There were a total of 3 mistakes for simple present in passive voice versus a total of 21 mistakes of simple present in active voice. Table 12 illustrates this significant difference found in the study in the use of simple present in active and passive voice.

Table 12

Mistakes made by students at the moment of using simple present in active and passive voice during their oral presentations

Mistakes in the use of simple present		
Passive voice	-the gas is contract -they are invest -it is operate	
Active voice	-air conditioners consumes -it compact it to -it consist -the gears that converts -all of them looks -the gears looks -each gear have -it doesn’t has -the gases goes -this kind of boiler have -the industry hasn’t	-it produce -the magnet create -it stop completely -what we need to implement this? -it is stay -the magnet need -this release -a geothermal energy contaminate -in this consist my project -this energy don’t have

It can be said then, that a future ESP course for mechanical engineers can be strengthened in the application of simple present through more spoken practice to raise more awareness in self-monitoring at the moment of using this verb tense in active voice.

Finally, in terms of fluency only two students were given the maximum score. Once again, being in front of an audience might have generated certain fear or insecurity in the students which ended up as some breakdowns in communication. This again, paves the way for expansion on speaking practice in an ESP course in a way that students can gain even more preparation to carry out oral transactions in their area of expertise.

Conclusions

In order to answer the research question posed at the beginning of this study, the results of this research were analyzed to conclude that students' performance in the assessments of productive skills share some similarities and differences.

Their task completion and vocabulary use were identified as a strength in both productive skills assessments, whereas grammar came out as a weakness in both as well. Simple present was a major grammatical issue in writing and speaking and therefore needs attention in a future course. On the other hand, there are contrastive results in relation to the specific constructs of each of the productive skills that differ from each other because of their nature. Nevertheless, these results pose thought-provoking implications for future researchers and instructors who are interested in teaching this course. Some of these implications include the need for thorough practice of specific grammar, vocabulary, and punctuation points; as well as other recommendations included in the following section.

Recommendations

In order to achieve better results in a future ESP course for mechanical engineers or in order to help students perform at a proficient level in similar speaking and writing assessment tasks, the researchers provide the following recommendations:

1) Enhancing and maximizing practice opportunities for punctuation rules. This would need to be done in a contextualized way through meaningful, authentic tasks in which students have opportunities to identify incorrect punctuation marks and placement.
2) Assigning and devoting, if possible, more time to writing in the pacing of the course as a means to guarantee deeper development of writing skills and writing language content.
3) Researching L1 interference with the correct use of punctuation marks in L2 through a writing diagnostic test in students' L1. Researchers can then compare the performance in both languages always considering the differences between both, and could analyze the type of error in L2 to determine if it corresponds to possible wrong punctuation in students' L1.
4) Creating more opportunities for speaking practice in order for students to start developing more self-monitoring skills at the moment of producing orally in the language.
5) Designing additional oral assessments in order to have at least a second task that allows comparison of data and its contrastive interpretation.

6) Setting a minimum (or maximum) number or words or paragraphs to be included in the tasks to prevent students from writing less than expected.

Limitations

This research study was not exempt from limitations. Even though the participant population displayed exemplary commitment, one of the main limitations was student attrition. The course started off with thirteen students from which only six finished. The reasons why seven students dropped out are unrelated to the course quality or delivery and obey to personal academic and professional circumstances that students encountered on the way. This was reported by them personally and via email. This led to a short amount of data that could be analyzed since only six students completed all assessment tasks in this study.

Another limitation is that there were plagiarism issues with three of the six students for one of the writing assessments. In order to obtain valid, reliable results, the researchers had students rewrite the plagiarized tasks with only original content. This process slowed down the data collection and analysis that perhaps could have been solved by a preventive, informative plagiarism warning and disclaimer before the writing assessments were carried out.

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Appendix A. Students Questionnaire A

University of Costa Rica
Master's Program in TEFL
Coto & Rojas
Cuestionario para Estudiantes

El siguiente cuestionario tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Cuestionario para estudiantes A

Parte I. Información personal

1. Nombre: ________________________________

2. Número de carnet: ________________________

3. Número telefónico: ________________________

4. Correo electrónico: ________________________

5 Indique su rango de edad con una X:

( ) 17-25 ( ) 26-35 ( ) 36-45 ( ) 46-60 ( ) 61 en adelante

6. Marque con una X la respuesta correcta. Usted es:

( ) Estudiante de ingeniería mecánica en la UCR.
( ) Estudiante de otra carrera en la UCR.
( ) Docente de ingeniería mecánica en la UCR.
( ) Docente de otro área en la UCR.
( ) No estudia ni labora en la UCR.

7. Prefiere ser contactado por:
( ) Correo ( ) WhatsApp

8. ¿Qué día podría asistir a un espacio en la universidad a realizar una prueba diagnóstico?

( ) Lunes ( ) Martes ( ) Miércoles ( ) Jueves ( ) Viernes ( ) Sábado

9. ¿En qué horario podría asistir a un espacio en la universidad a realizar una prueba diagnóstico?

( ) Mañana
( ) Tarde
( ) Tarde-noche
( ) Ningún horario me funciona

Parte II. Experiencia con el inglés

1. ¿Por cuántos años ha estudiado inglés?

( ) 1 año o menos
( ) 2 años
( ) 3 años
( ) 4 años
( ) 5 años o más
( ) Nunca he estudiado inglés

2. ¿Cuál considera que es su nivel de inglés actual?

( ) Nulo
( ) Principiante
( ) Intermedio
( ) Avanzado

3. ¿Está interesado(a) en llevar un curso de inglés específico para ingeniería mecánica el segundo semestre del 2019?

( ) Sí
( ) No

Parte III. Inglés en la Universidad.

1. Indique con una X la frecuencia con la que usted realiza las siguientes actividades utilizando el idioma inglés como estudiante de ingeniería mecánica.

	Siempre	**Casi siempre**	**A veces**	**Nunca**
1. Escribir				
2. Leer				
3. Hablar				
4. Escuchar				

2. Indique con una X la frecuencia con la que usted realiza las siguientes actividades utilizando el idioma inglés como estudiante de ingeniería mecánica.

a. Indique con una X la frecuencia con la que usted realiza las siguientes actividades escritas utilizando el idioma inglés como estudiante de ingeniería mecánica.

Escribir	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Escribir explicaciones de procesos.				
2. Escribir descripciones de procedimientos.				
3. Escribir reportes de laboratorio.				
4. Escribir correos electrónicos a expertos en ingeniería mecánica.				
5. Escribir correos electrónicos a docentes.				
6. Escribir correos electrónicos a compañeros.				
7. Tomar notas.				

b. Indique con una X la frecuencia con la que usted realiza las siguientes actividades de lectura utilizando el idioma inglés como estudiante de ingeniería mecánica.

Leer	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Leer artículos científicos.				
2. Leer artículos de revistas especializadas en ingeniería mecánica.				
3. Leer artículos de periódicos relacionados a ingeniería mecánica.				
4. Leer manuales explicativos.				
5. Leer manuales describiendo procesos.				
6. Leer libros explicando temas y conceptos generales de ingeniería mecánica.				

c. Indique con una X la frecuencia con la que usted realiza las siguientes actividades de expresión oral utilizando el idioma inglés como estudiante de ingeniería mecánica.

Hablar	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Discutir distintas formas de llevar a cabo un proceso.				
2. Hacer preguntas a expertos en ingeniería mecánica.				
3. Explicar procedimientos.				
4. Describir procesos.				

d. Indique con una X la frecuencia con la que usted realiza las siguientes actividades de escucha utilizando el idioma inglés como estudiante de ingeniería mecánica.

Escuchar	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Escuchar charlas de expertos en ingeniería mecánica en conferencias.				
2. Escuchar explicaciones de procesos para luego llevarlos a cabo.				
3. Escuchar descripciones de procedimientos para luego realizarlos.				
4. Escuchar explicaciones de expertos para aprender sobre temas específicos.				
5. Escuchar explicaciones de expertos para profundizar en ciertos temas.				

3. Indique alguna otra actividad, o actividades, que usted ha realizado utilizando el idioma inglés como estudiante de ingeniería mecánica que no se haya mencionado en las tablas anteriores. Si no hay alguna otra actividad, escriba "NA".

____

____

Parte IV. Inglés en el trabajo

1. ¿Ha trabajado como ingeniero (a) mecánico (a)? Puede ser en una compañía o llevando a cabo tareas de ingeniero(a) mecánico(a) como pasante.

( ) Sí

( ) No

* Si su respuesta es **Sí**, continúe el cuestionario en orden con el **ítem 2**. Si su respuesta es **No**, diríjase a **Parte V. Curso de inglés.**

2. Indique con una X la frecuencia con la que usted realiza las siguientes actividades utilizando el idioma inglés trabajando como ingeniero(a) mecánico(a).

	Siempre	**Casi siempre**	**A veces**	**Nunca**
1. Escribir				
2. Leer				
3. Hablar				
4. Escuchar				

3. Indique con una X la frecuencia con la que se realizan las siguientes actividades utilizando el idioma inglés trabajando como ingeniero(a) mecánico(a).

a. Indique la frecuencia con la que usted escribe utilizando el idioma inglés en el trabajo.

Escribir	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Escribir explicaciones de procesos.				
2. Escribir descripciones de procedimientos.				
3. Escribir reportes de laboratorio.				
4. Escribir correos a expertos en ingeniería mecánica.				
5. Escribir correos electrónicos a jefaturas.				
6. Escribir correos electrónicos a clientes				

7. Escribir correos electrónicos a compañeros.				
8. Tomar notas.				

b. Indique la frecuencia con la que usted lee utilizando el idioma inglés en el trabajo.

Leer	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Leer artículos científicos.				
2. Leer artículos de revistas especializadas en ingeniería mecánica.				
3. Leer artículos de periódicos relacionados a ingeniería mecánica.				
4. Leer manuales explicativos.				
5. Leer manuales describiendo procesos.				
6. Leer libros explicando temas y conceptos generales de ingeniería mecánica.				
7. Leer correos electrónicos con solicitudes.				
8. Leer correos electrónicos con contenido técnico.				

c. Indique la frecuencia con la que usted habla utilizando el idioma inglés en el trabajo.

Hablar	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Discutir distintas formas de llevar a cabo un proceso.				
2. Discutir procedimientos técnicos.				
3. Hacer preguntas a expertos en ingeniería mecánica.				
4. Explicar procedimientos para la producción de productos.				
5. Describir el funcionamiento de productos.				

d. Indique la frecuencia con la que usted escucha utilizando el idioma inglés en el trabajo.

Escuchar	**Siempre**	**Casi siempre**	**A veces**	**Nunca**
1. Escuchar charlas de expertos en ingeniería mecánica en conferencias.				
2. Escuchar explicaciones de procesos para luego llevarlos a cabo.				
3. Escuchar descripciones de procedimientos para luego realizarlos.				
4. Escuchar explicaciones de expertos para aprender sobre temas específicos.				
5. Escuchar explicaciones de expertos para profundizar en ciertos temas.				
6. Escuchar requerimientos sobre un producto.				

4. Indique alguna otra actividad, o actividades, que usted realiza en inglés trabajando en ingeniería mecánica que no se hayan mencionado en las tablas anteriores. Si no hay alguna otra actividad, escriba "NA".

____

____

Parte V. Curso de inglés.

1. Indique la frecuencia que quisiera que se practique cada una de las siguientes destrezas en el curso de inglés para ingeniería mecánica, siendo 4 con mucha frecuencia y 1 con poca frecuencia.

Destrezas	**1**	**2**	**3**	**4**
1. Escribir				
2. Leer				
3. Hablar				
4. Escuchar				

2. Marque con una X cuáles de los elementos en la columna de la izquierda considera que deberían incluirse en el curso de inglés para ingenieros mecánicos. Por favor especifique los temas y situaciones en caso de marcar la opción “SÍ”

	NO	**SÍ**	especifique temas o contextos
Escribir			
1. Escribir descripciones de procedimientos.			
2. Escribir reportes de laboratorio.			
3. Escribir correos a expertos en ingeniería mecánica.			

4. Escribir correos electrónicos a jefaturas.			
5. Escribir correos electrónicos a clientes			
6. Escribir correos electrónicos a compañeros.			
7. Tomar notas.			
Leer			
1. Leer artículos científicos.			
2. Leer artículos de revistas especializadas en ingeniería mecánica.			
3. Leer artículos de periódicos relacionados a ingeniería mecánica.			
4. Leer manuales explicativos.			
5. Leer manuales describiendo procesos.			
6. Leer libros explicando temas y conceptos generales de ingeniería mecánica.			
7. Leer correos electrónicos con solicitudes.			
8. Leer correos electrónicos con contenido técnico.			

	NO	**SÍ**	especifique temas o contextos
Hablar			
1. Discutir distintas formas de llevar a cabo un proceso.			
2. Discutir procedimientos técnicos.			
3. Hacer preguntas a expertos en ingeniería mecánica.			
4. Explicar procedimientos para la producción de productos.			
5. Describir el funcionamiento de productos.			
Escuchar			
1. Escuchar en conferencias charlas de expertos en ingeniería mecánica.			
2. Escuchar explicaciones de procesos para luego llevarlos a cabo.			
3. Escuchar descripciones de procedimientos para luego realizarlos.			
4. Escuchar explicaciones de expertos para aprender sobre temas específicos.			
5. Escuchar explicaciones de expertos para profundizar en ciertos temas.			
6. Escuchar requerimientos sobre un producto.			

3. Indique alguna otra actividad relacionada a leer, escribir, hablar o escuchar en inglés, en contextos laborales o universitarios, que le gustaría que se incluyera en el curso de inglés para ingeniería mecánica. Si no tiene ninguna, escriba NA.

____

____

4. Marque con una X la audiencia para la cual se requiere hacer las tareas de la izquierda.

Tareas	**Otros ingenieros**	**Clientes**	**Público general**	**Otros (especifique)**
1. Explicar cómo funciona una máquina a				
2. Explicar el ensamblaje de una máquina a				
3. Escribir correos a				
4. Describir regulaciones a				
5. Describir procedimientos a				

Indique con que otras personas se comunica usted en inglés en el campo de ingeniería mecánica, ya sea como estudiante o como trabajador(a). Si no se comunica con nadie diferente a los mencionados en la pregunta anterior, escriba NA.

____

____

5. De los siguientes temas, marque con una X las opciones que gustaría que se incluyeran en el curso.

Nuevas tecnologías	
Estándares y normas	
Mecánica de fluidos	
Termodinámica	

Elementos de máquinas	
Tecnologías de los materiales	
Procedimientos	
Componentes y ensamblaje	
Herramientas y partes de máquinas	
Diseño de proyectos	

6. ¿Hay algún otro tema que le gustaría que se incluyera en el curso de inglés para ingeniería mecánica?

____

____

Appendix B. Students Questionnaire B

University of Costa Rica
Master’s Program in TEFL
Coto & Rojas
Cuestionario para Estudiantes

El siguiente cuestionario tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Cuestionario para estudiantes B

Parte I. Información Personal

1. Indique su número de carnet: ____.

2. Indique su correo electrónico: ____.

3. Indique con una X el año de carrera que se encuentra cursando:

(   ) Primer año
(   ) Segundo año
(   ) Tercer año
(   ) Cuarto año
(   ) Quinto año
(   ) Ninguno. Soy egresado(a)

4. ¿Actualmente trabaja en el campo de ingeniería mecánica?

(   ) Sí
(   ) No

*Si su respuesta es sí, conteste la pregunta 5 y 6, si su respuesta es no, pase a la siguiente sección.

5. ¿Cuál es su puesto de trabajo?

____

6. ¿Dónde trabaja usted? Indique el nombre de la empresa.

____

Parte II. Comunicación en inglés

1. Lea las siguientes actividades e indique con una **X** cuales puede realizar con facilidad y cuáles le son difíciles de realizar.

Actividades	Puedo realizar con facilidad…	Para mí es difícil...
1. Escribir explicaciones de procesos.		
2. Escribir descripciones de procedimientos.		
3. Escribir reportes de laboratorio.		
4. Escribir correos electrónicos a expertos en ingeniería mecánica.		
6. Escribir correos electrónicos a jefaturas.		
7. Escribir correos electrónicos a docentes.		
8. Escribir correos electrónicos a compañeros.		
9. Tomar notas.		
10. Leer artículos científicos.		
11. Leer artículos de revistas especializadas en ingeniería mecánica.		
12. Leer artículos de periódicos relacionados a ingeniería mecánica.		
13. Leer manuales explicativos.		
14. Leer manuales describiendo procesos.		
15. Leer libros explicando temas y conceptos generales de ingeniería mecánica.		
16. Leer correos electrónicos con solicitudes.		
17. Leer correos electrónicos con contenido técnico.		
18. Discutir distintas formas de llevar a cabo un proceso.		

19. Hacer preguntas a expertos en ingeniería mecánica.		
20. Explicar procedimientos.		
21. Describir el funcionamiento de productos.		
22. Escuchar charlas de expertos en ingeniería mecánica en conferencias.		
23. Escuchar explicaciones de procesos para luego llevarlos a cabo.		
24. Escuchar descripciones de procedimientos para luego realizarlos.		
25. Escuchar explicaciones de expertos para aprender sobre temas específicos.		
26. Escuchar requerimientos sobre un producto.		

2. Indique alguna otra actividad comunicativa que le sea difícil de realizar en inglés.

____
____

Appendix C. Students Questionnaire C

University of Costa Rica
Master's Program in TEFL
Coto & Rojas
Cuestionario para Estudiantes

El siguiente cuestionario tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Cuestionario para estudiantes C

Parte I. Información Personal

1. Indique su número de carnet:
____.

2. Indique su correo electrónico:
____.

Parte II. Preferencias del Curso

1. De las siguientes actividades, en inglés, ¿Cuáles quisiera que se incluyan en el curso de inglés para ingeniería mecánica? Indique con una X en la columna B su respuesta según sus preferencias.

Actividades	B
1. Escribir explicaciones de procesos.	
2. Escribir descripciones de procedimientos.	
3. Escribir reportes de laboratorio.	
4. Escribir correos electrónicos a expertos en ingeniería mecánica.	
6. Escribir correos electrónicos a jefaturas.	
7. Escribir correos electrónicos a docentes.	
8. Escribir correos electrónicos a compañeros.	
9. Tomar notas.	
10. Leer artículos científicos.	
11. Leer artículos de revistas especializadas en ingeniería mecánica.	
12. Leer artículos de periódicos relacionados a ingeniería mecánica.	
13. Leer manuales explicativos.	
14. Leer manuales describiendo procesos.	
15. Leer libros explicando temas y conceptos generales de ingeniería mecánica.	
16. Leer correos electrónicos con solicitudes.	
17. Leer correos electrónicos con contenido técnico.	
18. Discutir distintas formas de llevar a cabo un proceso.	
19. Hacer preguntas a expertos en ingeniería mecánica.	
20. Explicar procedimientos.	

21. Describir el funcionamiento de productos.	
22. Escuchar charlas de expertos en ingeniería mecánica en conferencias.	
23. Escuchar explicaciones de procesos para luego llevarlos a cabo.	
24. Escuchar descripciones de procedimientos para luego realizarlos.	
25. Escuchar explicaciones de expertos para aprender sobre temas específicos.	
26. Escuchar requerimientos sobre un producto.	

2. Indique alguna otra actividad comunicativa que le gustaría que se incluye en el curso.

____

____

3. ¿Qué tipo de actividades quisiera que se realicen en el curso? Seleccione solo una opción.

( ) Individual ( ) En pareja ( ) En grupo

4. ¿Qué tipo de actividades quisiera que se realicen en el curso?

( ) Hacer presentaciones orales.
( ) Conversaciones con compañeros(as).
( ) Discutir temas.
( ) Realizar juegos de role (actuar o representar una situación real).
( ) Escuchar audios.
( ) Escuchar y tomar nota.
( ) Leer textos para responder a preguntas.
( ) Leer textos para seguir instrucciones.
( ) Leer textos en general, para diferentes fines.
( ) Escribir textos cortos.
( ) Completar ejercicios escritos.
( ) Quiz (Prueba corta) sorpresa.
( ) Auto-evaluación.

( ) Evaluación por parte de mis compañeros.
( ) Evaluación por parte de las docentes.
( ) Tareas adicionales para realizar fuera de hora de clase.

5. ¿Hay alguna otra actividad que le gustaría que se incluyera en el curso?

____
____

Appendix D. Students Unstructured Interview

University of Costa Rica
Master's Program in TEFL
Coto & Rojas
Entrevista Semi-estructurada para Estudiantes

Esta entrevista semi-estructurada tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Entrevista Semi-estructurada para Estudiantes

1. ¿Cuál ha sido su experiencia con el inglés?
2. ¿Cómo aprendió el idioma?
3. ¿Nos podría compartir algún texto o/y audio que haya utilizado recientemente?
4. ¿Qué es lo que más se le dificulta al hablar/leer/escribir/escuchar?
5. ¿Nos podría facilitar textos y/o videos o audios que haya utilizado relacionados a ingeniería mecánica?

Appendix E. Stakeholders Questionnaire

University of Costa Rica
Master's Program in TEFL
Coto & Rojas
Cuestionario para docentes o superiores

El siguiente cuestionario tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Cuestionario para docentes o superiores

Parte I. Información Personal

1. Nombre completo: ____.

2. Correo electrónico: _______________________________________.

3. ¿Es usted ingeniero(a) mecánico(a)?

(   ) Sí   (   ) No

Parte II. Introducción

1. ¿A qué se dedica un ingeniero(a) mecánico(a)?

____
____

2. ¿Qué tareas, de forma puntual, en general, realiza todo ingeniero mecánico?

____
____

Parte III. Estudiando Ingeniería Mecánica

1¿Qué tan importante es el inglés para un estudiante de ingeniería mecánica?

(1) Muy importante
(2) Importante
(3) Poco importante
(4) Nada importante

2. ¿Qué nivel de inglés se espera que tenga el estudiante al ingresar a la carrera?

( ) Nulo
( ) Básico
( ) Intermedio
( ) Avanzado

3. ¿Para qué tareas requiere el estudiante de ingeniería mecánica el idioma?

( ) Escribir
( ) Leer
( ) Escuchar
( ) Hablar

4. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escribir				
Leer				
Escuchar				
Hablar				

a. ESCRIBIR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escribir reportes				
Escribir resúmenes de reportes				
Tomar notas				
Escribir correos a profesores o coordinadores				
Escribir correos a compañeros				

b. LEER. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Leer manuales				
Leer artículos de revistas, periódicos y medios similares sobre ingeniería mecánica				
Leer artículos científicos				
Leer libros				
Leer planos				

c. ESCUCHAR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escuchar conferencias				
Escuchar explicaciones sobre temas específicos				
Escuchar descripciones de procedimientos				

d. HABLAR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Hablar con compañeros				
Hablar con docentes				
Explicar procedimientos				
Describir procesos				

Indique alguna otra actividad, o actividades, que realizan, en inglés, los estudiantes de ingeniería mecánica que no estén incluidas arriba. Si no hay alguna otra actividad, escriba "NA".

____

____

Parte IV. Trabajando en Ingeniería Mecánica

1. ¿En qué contexto se necesita el inglés?

____

____

2. ¿De qué forma se lleva a cabo la comunicación donde se necesita el inglés?

( ) Por teléfono
( ) Correo
( ) En persona

3. ¿Con qué personas se comunican en inglés, los ingenieros(as) mecánicos(as)?

( ) Jefaturas, superiores.
( ) Compañeros(as)
( ) Clientes
( ) Subordinados(as)

4. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escribir				
Leer				
Escuchar				
Hablar				

a. ESCRIBIR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escribir reportes				
Tomar notas				
Escribir correos clientes				
Escribir correos a compañeros				
Escribir correos a jefaturas				
Escribir procedimientos				
Escribir descripciones de productos específicos				

b. LEER. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Leer manuales				
Leer artículos de revistas, periódicos y medios similares sobre ingeniería mecánica				
Leer artículos científicos				
Leer libros				
Leer planos				
Leer correos				

c. ESCUCHAR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Escuchar conferencias				
Escuchar explicaciones sobre temas				
Escuchar descripciones de procedimientos				
Escuchar requerimientos				

d. HABLAR. Indique la frecuencia con la que se realizan las siguientes tareas en inglés.

	Siempre	Casi siempre	A veces	Nunca
Hablar con compañeros				
Hablar con jefaturas				
Hablar con clientes				
Describir procesos				
Explicar procedimientos				
Explicar funciones técnicas				
Discutir sobre procesos técnicos				

Indique alguna otra actividad, o actividades, que realizan, en inglés, los estudiantes de ingeniería mecánica que no estén incluidas arriba. Si no hay alguna otra actividad, escriba "NA".

Parte V. Elementos en la Comunicación para Ingeniería Mecánica

1. ¿Qué tan importante es el inglés para un ingeniero(a) mecánico(a)?

(1) Muy importante
(2) Importante
(3) Poco importante
(4) Nada importante

2. ¿Qué tan importante es poder comunicarse de forma oral fluidamente?

(1) Muy importante
(2) Importante
(3) Poco importante
(4) Nada importante

3. ¿Qué tan importante es conocer conceptos técnicos?

(1) Muy importante
(2) Importante
(3) Poco importante
(4) Nada importante

4. ¿Qué tan importante es comprender diferentes tipos de lecturas?

(1) Muy importante
(2) Importante
(3) Poco importante
(4) Nada importante

5. ¿Qué conflictos puede llegar a generar un error en comunicación?

____
____
____

Parte VI. Curso de Inglés

1. Indique el grado al que se deberían de incluir y trabajar las siguientes destrezas en el curso de inglés para ingeniería mecánica, según el nivel de importancia para desarrollarse exitosamente en esta carrera.

	Siempre	Casi siempre	A veces	Nunca
Escribir				
Leer				
Escuchar				
Hablar				

2. De los siguientes elementos, ¿Cuáles serían importantes incluir en curso de inglés?

( ) Leer artículos
( ) Leer libros
( ) Leer manuales
( ) Leer planos
( ) Escribir reportes
( ) Escribir resúmenes
( ) Escribir correos

( ) Escuchar conferencias
( ) Escuchar procedimientos
( ) Escuchar descripciones
( ) Seguir instrucciones
( ) Explicar procedimientos
( ) Describir procesos

3. ¿Qué otro elemento sería importante incluir en un curso de inglés para ingeniería mecánica?

____

____

4. De los siguientes temas, ¿Cuáles serían importantes incluir en curso de inglés?

( ) Nuevas tecnologías
( ) Estándares y normas
( ) Mecánica de fluidos
( ) Termodinámica
( ) Elementos de máquinas
( ) Procedimientos
( ) Componentes y ensamblaje

5. ¿Qué otros temas sería importante incluir en un curso de inglés para ingeniería mecánica?

____

____

Appendix F. Stakeholders Semi-Structured Interview

University of Costa Rica

Master's Program in TEFL

Coto & Rojas

Entrevista Semi-estructurada para Docentes o Superiores

Esta entrevista semi-estructurada tiene como propósito recolectar información para diseñar el curso de inglés específico para ingeniería mecánica para estudiantes de la Universidad de Costa Rica. Este proyecto es parte de los requisitos del programa de maestría de enseñanza del inglés como lengua extranjera. La información recolectada será confidencial.

Entrevista Semi-estructurada para docentes o superiores

1. ¿Qué tipo de reportes escriben los estudiantes en inglés?
2. Los libros, manuales, artículos y demás documentos que leen los estudiantes en inglés ¿son parte del material obligatorio de clase?
3. Cuando se habla de manuales, ¿qué tipo de manuales son? ¿Estos incluyen procedimientos paso a paso?
4. ¿Qué tipo de reportes escriben ellos?
5. ¿Cuáles son algunos procesos específicos que todo ingeniero mecánico debería de ser capaz de describir?
6. ¿Tiene ejemplos de documentos que ellos normalmente leen en inglés?
7. ¿Qué terminología es fundamental que todo ingeniero mecánico conozca?
8. ¿Nos puede compartir artículos, correos, lecturas etc., que tenga en inglés?
9. ¿Cómo cambia el rol de la escritura y la escucha en inglés al pasar de estudiante al trabajo? ¿Aumenta, disminuye, o no cambia?
10. ¿Dónde podemos encontrar artículos científicos de ingeniería mecánica en inglés?
11. ¿Cuáles son los seminarios y congresos a los que normalmente asisten? ¿Dónde podemos encontrar información (videos o grabaciones) de esos seminarios?
12. ¿Es común que los estudiantes de ingeniería tengan un nivel avanzado de inglés? ¿Cómo interfiere en la carrera el hecho de que no sepan inglés?

Appendix G. Diagnostic Test

Universidad de Costa Rica
English for Mechanical Engineering
Coto & Rojas
Prueba de Diagnóstico

El siguiente examen de diagnóstico tiene como propósito identificar áreas de mejora lingüísticas en actividades comunicativas relacionadas con la ingeniería mecánica. Esto con el fin de diseñar un curso que incorpore los elementos necesarios para ayudar a los participantes a desarrollar las competencias específicas necesarias en inglés. Los resultados de esta prueba son confidenciales.

Indicaciones Generales

- El examen tiene una duración máxima de 70 minutos a partir de que se le indique el inicio.
- Use los primeros 10 minutos para leer las instrucciones cuidadosamente y aclarar dudas acerca de las instrucciones en caso de ser necesario.
- Responda todas las preguntas en inglés.
- Lea cada pregunta cuidadosamente y responda según lo que se le solicite.
- Escriba de forma legible.
- No se permite el uso de diccionarios, teléfonos celulares o dispositivos móviles durante la prueba.

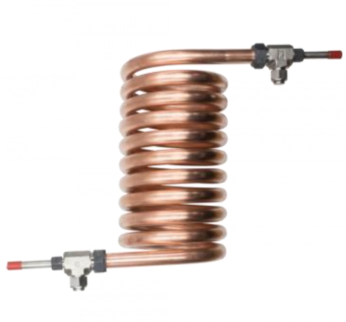
Nombre del estudiante: ________________________________.

Número de carnet: ____________________________________.

General performance:	
Reading performance: ___________	Writing performance: ___________
Listening performance: __________	Speaking performance: ___________
Notes about receptive skills:	Notes about productive skills:

Part 1. Reading and Writing

A. Look at the tools in the chart. Choose **one tool** and write a **short paragraph** describing it, **(1)** in terms of its material, **(2)** its appearance (include at least 2 characteristics) and **(3)** what it is used for (Include at least 3 uses). 12pts.

		
1	2	3

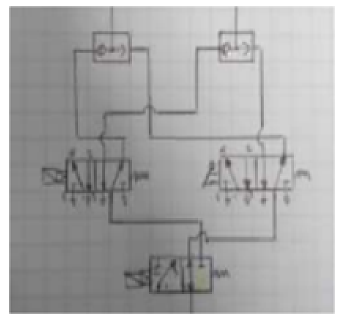
B. Read the text and answer the questions.

a. Read the following e-mail.

Hello Brandon

Can you quote me these components?

2 sensors PNP for a NCDQ8AZ106-250 cylinder (only the sensors, we already have the cylinder).
2 valves SY5140-5DZ
1 manifold SS5Y5-41-02-01N
1 blank plate SY5000-26-20A
1 relief valve with bracket VHS30-NO2B-B-Z
1 regulator AW30-NO2BG-Z-B
2 OR valve VR1210-01
1 electrovalve VP344-5DZ1-02NA



Let me explain to you something about this application. It includes a cylinder (NCDQ8AZ106-250) which is already installed and it is controlled by a manual valve, but we ned to include an electrovalve to control the cylinder. We will not remove the manual valve since it should be able to work completely in a manual mode in case there is a problem with the pic that controls the electrovalve. So we will have a cylinder connected to the two different valves, it will be a third valve (VP344) that will provide air to both valves (each output connected to a different valve). I am thinking of using OR valve (VR1210-01) connected to each port of the cylinder as you can see in the photo. Please tell me if I chose the right #part. Also I think I will need a quick exhaust between the cylinder and the OR valve, since the OR valve would not allow the air to return to the 5/2 valve. Can you offer me something?

b. Based on the email, write a reply email. 25 pts.

- Briefly state the requirements.
- Provide a response the question the provider states: “can you offer me something?”
- Properly conclude your response.
- Use an appropriate salutation and closing.
- Be concise.

C. Read the following abstract of a scientific article and mark with an X the answer for the following questions. 3 points.

A B S T R A C T

Simulation of a complete PV system shall stem from a Multiphysics perspective. Within a continuum modeling approach, among these physics, the thermal model of a PV panel is most crucial because all the other models are directly or indirectly related to it. As all models of a PV system are connected sequentially, error from one model component propagates to the next model component and the overall system error accumulates eventually. One of the main objectives of this work was to increase the prediction accuracy by developing a fully transient 2-D finite difference (FD) based thermal model. The developed computational code is completely generic and can be applied to any type of PV technology or configuration. It was shown in the study how to choose an appropriate grid size for any FD model. Using the developed code, various studies were also conducted. Modified radiation models, heat transfer coefficients and thermal networks for the PV panel were proposed in the study, which remarkably improved the accuracy of the thermal model. Also studied were the effects of including heat transfer from the sides of a PV panel and heat generation in the front glass cover. The results showed that ignoring the heat transfer from the sides of a PV panel and including heat generation in the front glass cover have no noticeable difference in the model prediction.

1. Letter _________contains the title that is more appropriate for the scientific article.

a) Thermal model of heat transfer
b) Photovoltaic modules for coupled irradiation
c) Thermal and performance predictive tool
d) Two-dimensional finite difference-based model

2. In the abstract the author mentions that “Modified radiation models, heat transfer coefficients and thermal networks for the PV panel were proposed in the study, which remarkably improved the accuracy of the thermal model.” Based on this, it can be inferred that:

a) The thermal model worked well
b) The PV panel showed an improvement in the networks
c) The study proposes a better accuracy of the thermal model
d) The effects of including modified radiation models were negative

3. The word “stem” in the first line is closest in meaning to:

a) Increase
b) Arise
c) Decrease
d) Cause

4. Explain the main idea of the abstract using your own words. 4 points.

____

____

____

D. Read the list of Possible Solutions and the list of Problems of Equipment Alarms. Match the problems of Equipment Alarms with the troubleshooting steps. Write the number of the Possible Solution in the parenthesis with the Problems of Equipment Alarms. 8 points.

POSSIBLE SOLUTIONS	
1	-Check that the main electric connection is plugged in. -Check that the corona heads are properly connected. -Verify that the front switch is in ON (I) position. -Check that the communication cable is properly connected.
2	-Check that the main electric connection is plugged in. -Check that the ultraviolet fiber is properly connected. -Verify that the front switch is in ON (I) position. -Check that the communication cable is properly connected.
3	-Verify that the "TIMER" LED light of the Omnicure is ON. If it is not, press the "MODE" button until it lights up.
4	-Verify the correct distance of the light fibers. -Verify that the Omnicure has the "CAL" LED light on, signal that the equipment was calibrated. -Verify the correct parameter of intensity in the Omnicure. -Verify the expiration date of the adhesive.

Problems of Equipment Alarms

( ) Machine doesn't make the Corona discharge.

( ) Machine doesn't make the ultraviolet curing cycle.

( ) On cycle, the ultraviolet curing cycle doesn't end, and I have to press the emergency button to stop the cycle

( ) After the curing cycle, the adhesive doesn't have a correct consistency (tacky).

( ) One motor doesn't move with any command and there isn't alarm.

( ) Gripper/hub holder/fiber cylinder doesn't respond to manual commands.

( ) Cured adhesive over the tubing and connections.

( ) During the cycle, the sheath doesn't go into the locating pin.

5	-The motor is on failure state, so hold the "CLEAN ALARMS" button in the alarm screen for 5 seconds to reset all the motors.
6	-Check that the machine has the air supply connected. -Verify that the inlet air is within the operating pressures.
7	-Verify that each component of the adhesive tubing is black (connectors, tubing) and that the needle has the protection sleeve.
8	-Verify that the fiber cylinders have the inner cone attached (item 108).

Part II. Listening

A. Listen to the audio about *How Does A Refrigerator Work?* | *Refrigeration Explained* and answer the questions.

Retrieved from https://www.youtube.com/watch?v=EIP3pSio7-M

Listen to the **first section** of the audio fill in the blanks.7 points.

Have you ever wondered how a refrigerator keeps your food fresh and provides you with a refreshingly chilled beverages on a hot day? Well let's find out.

Refrigeration is quite_______________, to understand the principles behind it just remember that when________________ ________________ it ________________ heat and when it ________________ it releases heat. A simple example is that when your hand is wet it feels cold this is the ________________ of water evaporating and ________________ your hand. On a very humid hot day your frosty beer will have water condensing on the outside of the bottle this warms your beer.

Listen to the **second section** of the audio fill in the blanks. 16 points.

A refrigerator uses five major _________________ : an expansion _________________ , evaporator _________________ , a _________________ , condenser _________________ , and a refrigerant. The refrigerant is a liquid that enters in the _________________ _________________ , as it passes through the sudden drop in pressure makes it expand, cool and turn it into gas. As refrigerant _________________ around the evaporator _________________ , it _________________ and remove heat from the food inside, the compressor squeezes the refrigerant, _________________ its temperature and _________________ . It's now a hot high-pressure gas. the refrigerant then _________________ through condenser _________________ on the back of the fridge, _________________ its heat to the atmosphere and cooling back into a liquid as it does so the refrigerant then re-enters the expansion _________________ and the cycle repeats itself. So basically, heat is constantly picked up from the inside of the refrigerator and taken outside of it.

B. Listen to the talk *Perpetual Motion Machines* and answer the questions.

Retrieved from https://www.youtube.com/watch?reload=9&v=A-QgGXbDyR0

Listen to the following section of the video (0:00 -1:27) and answer the questions below. 5 pts

1.What is a perpetual motion machine?

a) A machine with infinite sources of energy.
b) A machine that re-uses all the energy it spends.
c) A machine with no zero velocity points.
d) A machine that can do work with no power source.

2. Bhaskara’s sketch was one of the first designs for:

a) The wheel.
b) A perpetual motion machine.
c) The lightbulb.
d) The windmill.

3. Which statement paraphrases the video? Perpetual motion machines______________________.

a) work well depending on the design.
b) work because they follow 1 or more rules of thermodynamics.
c) don’t work with the rules of thermodynamics.
d) need to follow the rules of thermodynamics to work.

Listen to the following section of the video (1:28 - 3:00) and answer the questions below.

4. What was the problem with the variation of Bhaskara’s wheel?

1. The mercury on the rolling balls affected the functioning.
2. The axle was moved.
3. The center of mass was moved to a lower position.
4. The weights on the swing arms were too heavy.

5. Why won't the capillary bowl work?

1. The capillary force is too weak.
2. It requires extra energy to free the droplet.
3. It doesn't work with modern-day tubes.
4. It could only work in zero-gravity conditions.

Part III. Speaking. 25 points.

General instructions for test administrators:

1. Greet the student formally and make small talk to break the ice and make the student feel comfortable.
2. Explain that all questions and answers should be in English, without translating.
3. Start the oral test using the guide below.

A	*Ask the student to briefly talk about (him) herself. Can you tell me some information about yourself? (If student is hesitant with this question or if more information is necessary, ask the follow up questions) **Follow up questions:** Where do you live? When do you attend university classes? Which courses are you taking this semester? Why do you want to take this English class? *** If the student can't answer any of the previous questions, still provide instructions for Oral Task # 1 to verify proficiency level)	**Warm up** (DO NOT EVALUATE THESE QUESTIONS)
B	* Provide instructions for Oral Situation 1	EVALUATE ANSWER USING SPEAKING RUBRIC
C	* If student completes Oral Situation 1 at ease, move to Oral Situation 2 (Section D). On the contrary, if proficiency is very low or if the student is unable to complete the task, move to section E.	
D	* Provide instructions for Oral Situation 2	EVALUATE ANSWER USING SPEAKING RUBRIC
E	* Wind down the oral test: Well ___________ (name of student), this is the end of the test. Thank you very much for coming and for taking the time to take the test.	END OF THE THE TEST

Oral Situation 1 (Test Administrator)

A. Provide the student with the following instructions:

1. Read the situation carefully.
2. You need to provide an oral response including all the necessary information.
3. You will have two minutes to organize your ideas before you start speaking. If you are ready before the two minutes are over, you can start.

B. Now provide the situation card and allow the student to read it and ask questions if necessary.

Situation:

Imagine you are a mechanical engineer working at a multinational company and you are in a teleconference with the headquarters in USA. They want you to explain the main functions and applications of a product that your company makes (or that you know about).

- Introduce yourself.

- Describe the product's shape, materials, dimensions, applications, parts, and functions.

Oral Situation 1

Imagine you are a mechanical engineer working at a multinational company and you are in a teleconference with the headquarters in USA. They want you to explain the main functions and applications of a product that your company makes (or that you know about).

- Introduce yourself.

- Describe the product's shape, materials, dimensions, applications, parts, and functions.

Oral Situation 2 (Test Administrator)

A. Provide the student with the following instructions:

1. Read the situation carefully.
1. You need to provide an oral response including all the necessary information.
1. You will have two minutes to organize your ideas before you start speaking. If you are ready before the two minutes are over, you can start.

B. Now provide the situation card and allow the student to read it and ask questions if necessary.

Situation:

Imagine you are a technician and you are visiting a client who is having problems with the hydraulic circuits in the machine.

- Introduce yourself.
- Describe the problem, causes of the problem, and solutions to fix the issue.
- Mention the procedures and troubleshooting steps necessary to keep the equipment working properly.

Oral Situation 2

Imagine you are a technician and you are visiting a client who is having problems with the hydraulic circuits in the machine.

- Introduce yourself.
- Describe the problem, causes of the problem, and solutions to fix the issue.
- Mention the procedures and troubleshooting steps necessary to keep the equipment working properly.

Appendix H. General Group Profile

Job Position	All of the participants are mechanical engineering students at UCR, and only three of them are currently working.
Needs	Macro skills focus: All four macro skills with focus in reading, writing and listening. Reading tasks: Reading scientific articles, reading emails, reading books and manuals. Listening tasks: Listening to expert conferences, listening to descriptions and explanations of processes. Speaking tasks: Discussing technical processes, speaking to bosses and supervisors. Writing tasks: Writing emails, writing reports.
Wants	Macro skills focus: All macro skills with focus in speaking and listening Writing tasks: write explanations of processes, write descriptions of procedures, write lab reports, and write emails to experts in mechanical engineering. Reading tasks: read scientific articles, articles from specialized magazines, articles from newspapers related to engineering, explanatory manuals. Speaking tasks: Discuss different ways to carry out a process, ask questions to experts on mechanical engineering, explain procedures and explain how products work. Listening tasks: Listen to talks from experts in conferences, explanations of procedures to be carried out, explanations from experts to learn about specific topics, and listen about the requirements of a product. Topics: New technologies, fluid mechanics, thermodynamics, machines elements, materials technology, procedures, components and assembly, projects design and standards.
Language Experience	Students have studied English in school, kindergarten, primary school and high school. Few of them have taken English courses in the university and some of them have acquired vocabulary and have practiced reading by playing video games.

Perceived Proficiency	Most students perceive they are intermediates, seven perceive they are beginners and two of them perceive they are advanced students.
Lacks	Explain procedures and describe how a product works orally, discuss different ways to carry out a process, ask questions to experts Write descriptions and explain how a process works in a written form, write lab reports, emails to experts and supervisors.

Appendix I. Sample Mechanical Engineering Document in English

DAILY NEWS 19 July 2002

Second law of thermodynamics "broken"

By Matthew Chalmers

One of the most fundamental rules of physics, the second law of thermodynamics, has for the first time been shown not to hold for microscopic systems.

The demonstration, by chemical physicists in Australia, could place a fundamental limit on miniaturisation, because it suggests that the micro-scale devices envisaged by nanotechnologists will not behave like simple scaled-down versions of their larger counterparts – they could sometimes run backwards.

The second law states that a closed system will remain the same or become more disordered over time, i.e. its entropy will always increase. It is the reason a cup of tea loses heat to its surroundings, rather than being heated by the air around it.

"In a typical room, for example, the air molecules are most likely to be distributed evenly, which is the overall result of their individual random motion", says theoretical physicist Andrew Davies of Glasgow University. "But because of this randomness there is always a probability that suddenly all the air will bunch up in one corner." Thankfully this probability is so small it never happens on human timescales.

To the limit

Physicists knew that at atomic scales over very short periods of time, statistical mechanics is pushed beyond its limit, and the second law does not apply. Put another way, situations that break the second law become much more probable.

But the new experiment probed the uncertain middle ground between extremely small-scale systems and macroscopic systems and showed that the second law can also be consistently broken at micron scale, over time periods of up to two seconds.

Researchers led by Denis Evans at the Australian National University in Canberra measured changes in the entropy of latex beads, each a few micrometres across and suspended in water.

By using a precise laser beam to trap the beads, the team were able to measure the movement of the beads very frequently, and hence repeatedly calculate the entropy of the system at short time intervals.

Running in reverse

They found that the change in entropy was negative over time intervals of a few tenths of a second, revealing nature running in reverse. In this case, the bead was gaining energy from the random motion of the water molecule – the small-scale equivalent of the cup of tea getting hotter. But over time intervals of more than two seconds, on overall positive entropy change was measured and normality restored.

The team say their experiment provides the first evidence that the second law of thermodynamics is violated at appreciable time and length scales.

Their results are also in good agreement with predictions of the "fluctuation theorem", a theory developed at ANU 10 years ago to reconcile the second law with the behaviour of particles at microscopic scales.

"The results imply that the fluctuation theorem has important ramifications for nanotechnology and indeed for how life itself functions", claim the researchers.

Journal reference: *Physical Review Letters* **(vol 89, 050601)**

Appendix J. Diagnostic Test Speaking Tasks Rubric

UCR. English for Mechanical Engineers. Coto & Rojas.

Speaking Task Rubric

Student's name:____. Grade: ________________________________.

Score/ Category	**5**	**4**	**3**	**2**	**1**	Score
Grammar	Student is able to express complex ideas with ease by appropriately including variety of structures and correctly shifting from one tense to another.	Student most of the times expresses ideas with ease by including a variety of structures and properly shifting from one tense to another.	Student occasionally expresses ideas fairly well but some mistakes on tense application and shift were present.	Student rarely expresses ideas adequately, and shows inconsistencies on sentence structure use and tense shift.	Student is not able to communicate properly because of serious grammar mistakes and absence of tense shift.	
Vocabulary	Student is able to go beyond by using a rich and precise range of vocabulary applied to the field of study that allows for complex subjects descriptions.	Student is most of the time able to use an appropriate range of vocabulary related to the field of study, but does not show full command of lexical items to elaborate on complex subject descriptions.	Student is sometimes able to use vocabulary words related to the field of study, but doubtingness and repetitiveness hinder him/her from expanding on the ideas.	Student displays a very simple command of vocabulary to express his/her ideas properly, which highly hinders communication and expansion of ideas.	Student shows an inadequate and inaccurate command of vocabulary that totally hinders communication and elaboration of ideas.	
Content	Student's descriptions are clear and detailed for the task and go beyond the expected.	Student most of the time offers clear descriptions for the task, but does not consistently go beyond the expected.	Student partially elaborates on details required for the task and does not go beyond as ideas are connected in a simple way.	Student barely elaborates on the details required for the task.	Student does not address the content expected for the task.	
Pronunciation & intonation	Pronunciation and intonation of words and sentences are very clear and natural and most of the time allow the listener to understand the message.	Pronunciation and intonation of words and sentences are usually clear to allow the listener to understand the message.	Pronunciation and intonation of words and sentences are sometimes clear to allow the listener to understand the message.	Pronunciation and intonation of words and sentences are not clear most of the time, so listener's understanding of the message gets highly hindered.	Pronunciation and intonation of words and sentences are not clear and as a result hinder the listener from understanding the message.	
Fluency	Production of speech is effortless and with a natural speed. No hesitation or breakdowns are present.	Production of speech is smooth, but little hesitation appears causing rephrasing and minor breakdowns in communication.	Production of speech is affected by some hesitation causing moderate breakdowns in communication.	Production of speech is affected by significant amounts of hesitation and creates important breakdowns in communication.	Production of speech is highly hindered by hesitation and student stumbles and looks uncertain in the development of the responses.	
					Total Score	

Grammar	Pronunciation
Vocabulary	Others

Adapted from: Gear up - course designed by Elizondo, F., Pilgrim, Y., & Sánchez, E.(2018) // https://www.rcampus.com/rubricshowc.cfm?code=L47B46&sp=yes& // https://www.dcs.k12.oh.us/cms/lib07/OH16000212/Centricity/Domain/104/Rubric_Speaking.pdf // *Council of Europe. The CFR online [PDF]. Common European Framework of Reference for Languages. Available at http://www.coe.int/t/dg4/linguistic/cadre1_en.asp p. 35-36.*

Appendix K. Diagnostic Test Writing Task 1 Rubric

UCR. English for Mechanical Engineers.
Coto & Rojas.
Rubric for writing task # 1. **Points Obtained: __________ Grade Obtained: ___________**
Student's name:____.

Category / Rating	Task Completion	Vocabulary	Grammar	Mechanics
3	-Writing is complete and includes in detail all of the indicated aspects related to materials, appearance and use.	Writing includes appropriate technical vocabulary to describe materials, appearance and use.	-Grammar structures used are precise with no mistakes that distract the reader from understanding all the points requested.	-Writing is precise with only a few to no errors in punctuation, spelling or capitalization. Absence of fragments and run-on sentences.
2	-Writing includes a few details that are relevant and relate to the requirements of the text in relation to materials, appearance and use.	-Vocabulary does not fully incorporate words to describe materials, appearance and use.	-Uses variety of structures, but some mistakes are made distracting the reader from understanding at some points.	-Writing presents some errors in capitalization, spelling or punctuation. There are some fragments and run-on sentences.
1	-Writing is not complete and ideas are poorly developed to describe the aspects related to materials, appearance and use.	-Very poor use of vocabulary to describe materials, appearance, and use.	-Use of structures is very simple and limited, and errors found in the writing highly interferes with understanding.	-Serious errors in capitalization, spelling or punctuation. Writing is highly affected by the presence of fragments and run-on sentences in most of the ideas.

Appendix L. Diagnostic Test Writing Task 2 Rubric

UCR. English for Mechanical Engineers.
Coto, Gómez & Rojas.
Rubric for writing task # 2. **Points Obtained __________** **Grade Obtained: ___________**
Student's name:____.

Category/Rating	Task Completion	Vocabulary	Grammar	Mechanics	Organization
5	-Writing concisely includes all of the indicated aspects to properly compose the email.	-Response includes appropriate technical vocabulary to be understood.	-Grammar structures used are precise with no mistakes that distract the reader from understanding the text. -Sentences are well constructed.	-Writing is precise with only a few to no errors in punctuation, spelling or capitalization. -Absence of fragments and run-on sentences.	-Writing follows a logical flow with a clear salutation, statement of requirements, a response to the question, conclusion of the response, and closing.
3	-Writing includes the majority of the indicated aspects to compose the email; however, some sections are omitted or may be incorrectly developed.	-Response lacks some appropriate technical vocabulary for it to be fully understood.	-Grammar structures used present some mistakes that distract the reader from understanding at some points.	-Writing presents some errors in capitalization, spelling or punctuation. -There are some fragments and run-on sentences.	-Writing flow is affected as some of the ideas are not developed in the most logical order.
1	-Writing includes only one or two of the indicated aspects to properly compose the email.	-There is absence of appropriate technical vocabulary for the response to be understood.	-Use of structures is very simple and limited, and errors found in the writing highly interfere with understanding.	-Serious errors in capitalization and punctuation. -Writing is highly affected by the presence of fragments and run-on sentences in most of the ideas.	-The flow of ideas is very disorganized and causes confusion to the reader.

Appendix M. Summary of Results

Skills	Obt. Socore/Total	Strengths	Weaknesses
Reading	**4.5 / 15**	Making inferences Skimming for general ideas	Identifying specific processes that involve several parts or steps. Distinguishing cause and effect. Scanning for extracting details
Writing	**15.2 / 37**	Knowledge of basic technical vocabulary Overall use of tenses in active voice Punctuation, conjunctions, verb patterns. Use of cohesive devices Organization and task completion (Communicative functions of form and purpose)	Passive voice Spelling Demonstratives Definite and indefinite Articles Pluralization SV agreement

Listening	**10.9 / 28**	Processing speech to recognize general ideas Retaining chunks of language in short-term memory	Processing speech to recognize details Distinguishing between literal and implied meaning
Speakin g	**14.5 / 25**	Using basic grammatical word classes (nouns, verbs, etc.). Making attempts to incorporate more complex grammatical systems. Using some technical vocabulary.	Using complex grammatical systems, patterns, and rules. Expressing a particular meaning in different grammatical forms Using an adequate number of lexical units to accomplish pragmatic purposes. Monitoring oral production Using cohesive devices in spoken discourse
TOTAL	**45.1 / 105**		

Appendix N. Student Syllabus

University of Costa Rica
Master's program
English for Mechanical Engineers
Course name: The Gearbox: Engineering your English

Instructors: Coto, L. & Rojas, G.

Schedule: Mondays from 5:00 p.m. to 7:50 p.m at the School of Mechanical Engineering.

I. Course Description

This is an ESP course for mechanical engineering students at UCR, intended for basic and independent users of the language according to The Common European Framework of Reference for Languages. The course will be taught by three language instructors, once a week on Mondays. Each lesson will last three hours, starting at 5:00 p.m. and finishing at 7:50 p.m.

The course will address the four macro skills with a stronger emphasis on reading and writing. It will also devote some time to the development of speaking and listening tasks. These skills will be enhanced through the exposure to real-life tasks, appropriate strategies, a meaningful language focus per lesson, and authentic materials from the field of mechanical engineering. During this course, students will be able to demonstrate comprehension of technical engineering texts, write specific documents related to the field, and orally exchange technical information with others.

II. Goals and Objectives

Unit 1. Expanding your Knowledge

Goal: By the end of the unit, students will be able to successfully demonstrate comprehension of different texts with technical vocabulary by implementing reading strategies.

General objectives:

By the end of the lesson, students will be able to:

1. Accurately define general mechanical engineering vocabulary by guessing meaning from the context of written texts about general mechanical engineering topics.
2. Successfully identify the main ideas and details in sample texts about new technologies by using skimming and scanning strategies.

3. Correctly recognize the purpose of formal work email samples by summarizing and restating the reason of the emails.

Unit 2. Engineering Production

Goal: By the end of the unit, students will be able to write emails, descriptions of procedures and processes, and lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.

General objectives:

By the end of the lesson, students will be able to:

1. Properly write inquiry emails to experts in mechanical engineering by following the format of sample emails provided.
2. Coherently write the description of mechanical procedures in the workplace by clearly listing steps required for the procedure to be completed.
3. Accurately construct a one-page lab report introduction by including the *what* and the *why* of a study or experiment for informative purposes.

Unit 3. Exchanging Ideas

Goal: By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues and superiors by actively listening, asking questions, and reporting information orally.

By the end of the lesson, students will be able to:

1. Successfully demonstrate understanding of information presented orally by experts and react to it by asking questions and providing appropriate responses.
2. Appropriately discuss technical processes with colleagues by sharing their point of view and exchanging ideas in order to find the most suitable solution.
3. Accurately explain a future project design to clients, superiors and colleagues by organizing the ideas, including details and the necessary technical vocabulary.

III. Methodology

The course will be developed through the implementation of communicative, real-life-oriented tasks that will allow the students to achieve the goals and objectives established for each of the units. These tasks will be carried out through reading activities involving the study of technical vocabulary, strategies to understand main ideas and details in texts; email features, procedures in manuals, and lab report sections. It will also expose students to speaking activities in which they properly react to experts' ideas by asking questions and providing responses. This area will also include the discussion of processes with colleagues as well as the proposal of a future project to clients, superiors, and colleagues. For the purpose of this course, individual, pair, and group work will be expected from the students as they take part of the activities already described. Students are expected to participate actively and cooperate with meaningful contributions to the class in order to make the most of it. If the student skips class more than three times, the course certificate will not be granted.

IV. Assessment

The course will require students to complete the following assessment tasks and get a minimum of 8 in the final grade to pass.

Assessment distribution	Percentages
Reading and vocab test………………………..……	20%
Writing task 1: Email reply …………………………	15%
Writing task 2: Lab report (intro)…………….……...	10%
Grammar quiz……………………………….………...	10%
Listening quiz. ……………………………..…...…	10%
Writing task 3: Project progress report………..…...	10%
Project oral presentation…………………...……...	15%
In-class tasks portfolio……………………………...	10%

V. Contents

The units that will be covered during the course are the following:

Unit 1: Expanding your Knowledge.

Unit 2: Engineering Production.

Unit 3: Exchanging Ideas.

Appendix O. ESP Course Evaluation Form

Unit 1 Evaluation form

Instructions: Write an X in the column that best represents your opinion about each of the statements for unit 1 in the ESP course.

The content of unit 1…	**Always**	**Usually**	**Rarely**	**Never**
was updated.				
was well organized.				
stimulated my interest.				
was useful for my professional life.				
was relevant for my professional life.				
increased my knowledge on the topic.				
was appropriate for my proficiency level.				
helped me to improve my ability to use context clues.				
helped me to improve my ability to summarize emails.				
helped me to improve my ability to identify details in texts.				
helped me to improve my ability to identify main ideas in texts.				
helped me to improve my ability to restate the purpose of emails.				
The materials…				
helped to improve my understanding of grammar points studied.				
helped me to improve my ability to use reading strategies studied.				
were appropriate for my proficiency level.				
were relevant for my professional life.				
presented ideas and concepts clearly.				
were well-presented.				
were well-organized.				
were attractive.				
The activities …				
reflected the real-life of a mechanical engineer.				
helped me to achieve the objectives of the unit.				
were appropriate for my proficiency level.				
reflected the contents of the course.				
were effective for my learning.				
promoted participation.				
were challenging enough.				
were motivating.				
were varied.				

Instructions: Write your answer in English or in Spanish to the following questions.

What are three suggestions to improve this course for the following unit?

1.____
____

2.____
____

3.____
____

What are three things you really enjoyed during unit 1?

1.____
____

2.____
____

3.____
____

What are three things you would like to see or do in unit 2 which focuses on writing?

1.____
____

2.____
____

3.____
____

Thanks for your feedback!

Appendix P.

Student-Teacher Evaluation Form

Instructions: Please mark with an “x” the column that best represents your perception about the teachers’ performance in class. Your feedback will be highly appreciated.
Please select the teacher you are evaluating:

☐ Laura Coto.
☐ Garyan Rojas.

The teacher:	Always	Usually	Rarely	Never
1. Is ready before class.				
2. Allows students to be the protagonists of the class.				
3. Promotes active participation from students.				
4. Prepares materials that facilitate learning.				
5. Uses content that is relevant to mechanical engineers.				
6. Brings variety of activities to the class.				
7. Provides clear instructions.				
8. Is always willing to clarify doubts.				
9. Manages time appropriately				
10. Constantly monitors students’ work.				
11. Provides clear feedback.				
12. Promotes an environment of respect in the class.				
13. Plans lessons that prepare students appropriately for evaluations.				

Please answer these questions:

1. What can the teacher do to improve her lessons?

2. What can the teacher continue implementing in her classes?

Thanks for your feedback!

Appendix Q. Writing Assessment Task 1

NAME:________________________________. Points Obt: ______ / 25
Grade______.

General instructions:

1) Use blue or black ink.
2) Cellphones, computers, or extra paper are not allowed during the writing quiz.
3) Check instructions carefully.
4) Time allotted: 30 minutes.

Instructions: Read the email thread below and write a complete response in which you include all the information requested. Keep a formal tone and include all the elements necessary to compose a complete email. Your writing will be assessed by using the rubric attached to this document.

Subject	SMC Pneumatic components quotation – Urgent
From	carlos.scott@smartsolutions.com
To	bbrown@easternsupplier.com
Date	October 10th, 2019, 2:00 p.m.

Dear Mr. Brown,

We are working on a new project in which I am thinking of using SMC Pneumatic components. Can you quote me the following part numbers?

1 x VX230CGL VX2*0, Single Unit, Direct Operated NC
1 x VX232KGL, VX2*2, Single Unit, Direct Operated 2 Position 1 x VP344-5DZI-02NA

2 x SOCV2-F4N-1P-SS, ¼" FNPT Check Valve, 1 psi crack pressure
1x TIL07-20, TUBING, FLUOROPOLYMER TIL/TL ¼" FLUORINE TUBING
10 x KQG2H07-N02S, FITTING, SUS, MALE CONNECT KQG ¼ INCH

This is urgent, so I will really appreciate a quick response to complete the purchase as soon as possible to get the parts delivered in no more than nine days in the same order.

Thanks.

Regards,

Carlos

Subject	SMC Pneumatic components quotation – Urgent
From	bbrown@easternsupplier.com
To	carlos.scott@smartsolutions.com
Date	October 10th, 2019, 4:30 p.m.

Dear Carlos,

Please see the prices and lead time on the following table:

Let me know if you have any questions or comments.

Description	Part Number	Qty	Unit Price USD	Lead time
Valve Model VX2*0, Single Unit, Direct Operated NC	VX230CGL	1	54.85	1 week
Valve VX2*2, Single Unit, Direct Operated 2 Position	VX232KGL	1	96.85	1 week
Valve Model VP300, 3 port, solenoid, base mount, single unit	VP344-5DZI-02NA	1	79.45	6 weeks
Check Valve, ¼ FNPT, 1 psi crack pressure	SOCV2-F4N-1P-SS	1	38.35	1 week
TUBING, FLUOROPOLYMER TIL/TL ¼" FLUORINE TUBING	TIL07-20	1	155.10	1 week
FITTING, SUS, MALE CONNECT KQG ¼ INCH	KQG2H07-N02S	10	12.95	1 week

Regards,

Bryan

****

Subject	SMC Pneumatic components quotation – Urgent
From	carlos.scott@smartsolutions.com
To	bbrown@easternsupplier.com
Date	October 11th, 2019, 8:00 a.m.

**If necessary, use the back of the page to continue writing.*

Appendix R. Writing Assessment Task 2

English for Mechanical Engineers
Instructors: Coto, L. & Rojas, G.

Engineering your English

Writing Task 2: Lab Report Introduction

NAME: _______________________. Points Obt: ______ / 25 Grade______.

Instructions:

Scan the QR code and read the lab report whose introduction is missing. Then, write a complete introduction and include the following elements as suggested by the IMRaD format:

- background on the field needed to understand the text
- a thesis statement
- a hypothesis
- the objective of the lab report
- the reason for conducting the research.

QR CODE:

SCAN ME

Appendix S. Writing Assessment Task 3

English for Mechanical Engineers
Instructors: Coto, L. & Rojas, G.

Engineering your English

Writing Task 3: Project Written Report Guidelines

Purpose: To explain the final oral presentation's project proposal and describe relevant steps, stages, materials, and processes involved.

GUIDELINES

- ✓ Describe your project proposal in detail pretending it is for a customer.
- ✓ Type the report using Arial # 12 and double space the text.
- ✓ Report length: Two pages maximum
- ✓ Include information about specifications and design or prototype. You can add any additional information you consider necessary.
- ✓ Mention which global goal the project supports. (Refer to link shared in guidelines for final project presentation).
- ✓ Use formal, descriptive language.
- ✓ You can add images, figures, and graphs if necessary.
- ✓ Incorporate grammar and vocabulary studied in class. Refer to glossaries, writing aid, and portfolio materials.
- ✓ Proofread your report carefully to avoid spelling, punctuation, and grammar mistakes.
- ✓ Make sure your report is coherent and well organized.

Appendix T. Oral Assessment Task

English for Mechanical Engineers
Instructors: Coto, L. & Rojas, G.

Engineering your English

Guidelines for Project Oral Presentation

Objective: To prepare an oral presentation of a product, project, or process that will be shown to a potential client in a meeting in order to convince the organization to invest in your idea.

General Guidelines:

1. This project is individual.
2. You are allowed to use a PPT for visual support, but make sure the material is professional and not full of text.
3. You are allowed to use note cards if necessary, but the presentation should be as natural as possible. Don't read it!
4. The presentation should last no less than 8 minutes and no more than 10.

Instructions:

A. Choose the product, project, equipment, tool, or process that you want to make the presentation about. It can be of your own creation or you can use any of the ideas in the website: https://nevonprojects.com/mechanical-engineering-projects/

B. Once you have your choice, think about the impact of your idea. Go to the website https://www.globalgoals.org/ in order to choose one or two of the global goals from the list that your project has an impact on. Include and mention this on your presentation. This gives your project and extra positive impact.

C. Prepare your presentation using the following questions as a guide. You don't have to answer all the questions in your presentation, and you can address other information if necessary. These questions are only a <u>guide</u> for you to decide what the most relevant information that you want to include in your project is. Remember that you need to "sell" your idea so you need to be convincing!

Guiding Questions for the Project

Who?	**1-** Who benefits / will benefit from this project? (Organization, company, client, etc) **2-** Who have you also heard discuss this? **3-** Who will be the key people in this project?
What?	**1-** What are the strengths and weaknesses of this project? **2-** What is another alternative to this project? **3-** What would be a counter-argument to this project?
Where?	**1-** Where is this project most needed? **2-** Where in the world would this project be a problem? **3-** Where will this idea take the organization, company, or client?
When?	**1-** When will this project benefit the organization, company, client ? **2-** When would / will this project cause problem? **3-** When will you know if you have succeeded?
Why?	**1-** Why is this project a challenge? **2-** Why is this project relevant to the organization / company / client? **3-** Why is this project necessary today?
How?	**1-** How is this project similar to other projects? **2-** How does this project benefit the organization / company / client? **3-** How do you see this project in the future?

Appendix U

E-mail Reply Assessment Rubric

Student's name: ____. Points obtained: __________. Grade: __________.

Category Score	**Task Completion**	**Vocabulary**	**Grammar**	**Mechanics**	**Organization**
5	-Writing task includes all required elements.	-Response includes appropriate technical vocabulary related to machine parts, tools, and -new technologies. -There is appropriate use of sequencers and linking words.	-Grammar structures are precise and correct in meaning and form. - Studied structures are used with no to few mistakes that distract the reader from understanding the text. -All or most sentences are well constructed.	-Writing is precise with only a few to no errors in punctuation, spelling, and/or capitalization. -There is absence of fragments and run-on sentences.	-Writing follows a logical flow starting with a clear salutation followed by a response to the queries, conclusion of the response, and closing.
3	-Email includes the majority of the indicated aspects to compose the email; however, some sections are omitted or may be incorrectly developed.	-Response lacks some technical vocabulary related to machine parts, tools, and new technologies - There is incorrect use of some sequencers and linking words.	-Grammar structures present some mistakes in meaning and/ or form. - Studied structures present some mistakes that distract the reader from understanding at some points. - Some sentences are well constructed.	-Writing presents some errors in capitalization, spelling, and/or punctuation. -There are some fragments and run-on sentences.	-Writing flow is affected as some of the ideas are not developed in the most logical order.
1	-Email includes only one or two of the indicated aspects to properly compose the email.	-There is absence of appropriate technical vocabulary related to machine parts, tools, and new technologies - There is absence of sequencers and linking words.	-Use of structures is basic and limited, and errors found in the writing highly interfere with understanding. -There is limited to no use of studied structures. -Most sentences lack good construction.	-Writing presents serious errors in capitalization, spelling, and/or punctuation. -Writing is highly affected by the presence of fragments and run-on sentences in most of the ideas.	-The flow of ideas is disorganized and causes confusion to the reader.

SECTION II: Instructions: Mark YES or NO for each of the statements below about what the student can or cannot do based on the email he/she wrote.

		YES	NO
Independent level of performance	Can maintain a relationship through personal correspondence using the language fluently and effectively to give detailed descriptions of experiences, pose sympathetic questions and follow up issues of mutual interest.		
	Can write formal emails with appropriate register, structure, and conventions appropriate to the context.		
	Can write basic formal emails/letters, for example to make a complaint and request action. Can write basic emails/letters of a factual nature, for example to request information or to ask for and give confirmation.		

***If you marked YES for all the statements above, continue with to the next section. Otherwise, stop here.

		YES	NO
Proficient level of performance	Can write virtually any type of correspondence necessary in the course of his/her professional life in an appropriate tone and style.		
	Can write formal correspondence such as emails of clarification, application, recommendation, reference, and complaint with good expression and accuracy.		

Can-do statements adapted from Common European Framework of Reference for Language's Companion Volume with New Descriptors
Taken from https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989

Appendix V

Lab Report Introduction Assessment Rubric

Student's name: ____. Points obtained: __________. Grade: __________.

Category Score	**Task Completion**	**Vocabulary**	**Grammar**	**Mechanics**	**Organization**
5	-Lab report introduction includes all required elements. - Lab report introduction is fully developed.	-Introduction includes appropriate technical vocabulary related to machine parts, tools, and new technologies -There is appropriate use of sequencers and linking words	-Grammar structures are precise and correct in meaning and form. - Studied structures are used with no to few mistakes that distract the reader from understanding the text. - All or most sentences are well constructed.	-Writing is precise with only a few to no errors in punctuation, spelling, and/or capitalization. -There is absence of fragments and run-on sentences.	-Writing follows a logical flow of ideas that helps the reader to understand the written piece.
3	-Report includes the majority of the indicated aspects to compose the lab report introduction; however, some sections are omitted or may be not fully developed.	- Introduction lacks some technical vocabulary related to machine parts, tools, and new technologies - There is incorrect use of sequencers and linking words.	--Grammar structures present some mistakes in meaning and/ or form. - Studied structures present some mistakes that distract the reader from understanding at some points. - Some sentences are well constructed.	-Writing presents some errors in capitalization, spelling, and/or punctuation. -There are some fragments and run-on sentences.	-Writing flow is affected as some of the ideas are not developed in the most logical order.
1	-Report includes only one of the indicated aspects to properly compose the lab report introduction - Lab report Introduction is not fully developed.	-There is absence of appropriate technical vocabulary related to machine parts, tools, and new technologies - There is absence of sequencers and linking words.	--Use of structures is basic and limited, and errors found in the writing highly interfere with understanding. -There is limited to no use of studied structures. -Most sentences lack good construction.	-Writing presents serious errors in capitalization, spelling, and/or punctuation. . -Writing is highly affected by the presence of fragments and run-on sentences in most of the ideas.	-The flow of ideas is disorganized and causes confusion to the reader.

SECTION II: Instructions: Mark YES or NO for each of the statements below about what the student can or cannot do based on the lab report he/she wrote.

		YES	NO
Independent level of performance	Can write an essay or report that develops an argument systematically with appropriate highlighting of significant points and relevant supporting details.		
	Can write short, simple essays on topics of interest.		
	Can write very brief reports to a standard 221onventionalized format going beyond factual information.		
	Can summarise, report and give his/her opinion about accumulated factual information on familiar routine and non-routine matters within his/her field with some confidence.		

***If you marked YES for all the statements above, continue with to the next section. Otherwise, stop here.

		YES	NO
Proficient level of performance	Can write a suitable introduction to a longer report, article or dissertation on a complex academic or professional topic if the topic is within his/her field of interest and there are opportunities for redrafting and revision.		

Can-do statements adapted from Common European Framework of Reference for Language's Companion Volume with New Descriptors
Taken from https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989

Appendix W

Project Progress Report Assessment Rubric

Student's name: ______________________________________. Points obtained: __________. Grade: __________.

Category Score	Task Completion	Vocabulary	Grammar	Mechanics	Organization
5	-Report includes all of the indicated aspects to describe the product or process they created. -- Project progress report is fully developed.	-Report includes appropriate technical vocabulary related to machine parts, tools, and new technologies -There is appropriate use of sequencers and linking words.	-Grammar structures are precise and correct in meaning and form. - Studied structures are used with no to few mistakes that distract the reader from understanding the text. - All or most sentences are well constructed.	-Writing is precise with only a few to no errors in punctuation, spelling, and/or capitalization. -There is absence of fragments and run-on sentences.	-Writing follows a logical flow of ideas that helps the reader to understand the written text.
3	-Report includes the majority of the indicated aspects to describe the product or process of their creation; however, some sections are omitted or may be not fully developed.	- Report lacks some technical vocabulary related to machine parts, tools, and new technologies - There is incorrect use of sequencers and linking words.	--Grammar structures present some mistakes in meaning and/ or form. - Studied structures present some mistakes that distract the reader from understanding at some points. - Some sentences are well constructed.	-Writing presents some errors in capitalization, spelling, and/or punctuation. -There are some fragments and run-on sentences.	-Writing flow is affected as some of the ideas are not developed in the most logical order.
1	-Report includes a few of the indicated aspects to properly describe their product or process. - Project progress report is not fully developed.	-There is absence of appropriate technical vocabulary related to machine parts, tools, and new technologies - There is absence of sequencers and linking words.	--Use of structures is basic and limited, and errors found in the writing highly interfere with understanding. -There is limited to no use of studied structures. -Most sentences lack good construction.	-Writing presents serious errors in capitalization, spelling, and/or punctuation. . -Writing is highly affected by the presence of fragments and run-on sentences in most of the ideas.	-The flow of ideas is disorganized and causes confusion to the reader.

SECTION II: Instructions: Mark YES or NO for each of the statements below about what the student can or cannot do based on the project report he/she wrote.

		YES	NO
Independent level of performance	Can evaluate different ideas or solutions to a problem.		
	Can write an essay or report which develops an argument, giving reasons in support of or against a particular point of view and explaining the advantages and disadvantages of various options.		
	Can write short, simple essays on topics of interest.		
	Can write a text on a topical subject of personal interest, using simple language to list advantages and disadvantages, give and justify his/her opinion.		

If you marked YES for all the statements above, continue with to the next section. Otherwise, stop here.

		YES	NO
Proficient level of	Can write a suitable introduction and conclusion to a longer dissertation on a complex academic or professional topic that is within his/her field of interest.		
	Can write clear, well-structured expositions of complex subjects, underlining the relevant salient issues.		

Can-do statements adapted from Common European Framework of Reference for Language's Companion Volume with New Descriptors
Taken from https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989

Appendix X

Project Oral Presentation Assessment Rubric

Student's name: ____. Points obtained: __________. Grade: __________.

Score Category	**5**	**4**	**3**	**2**	**1**
Grammar	-Student is able to express complex ideas with ease by appropriately including studied structures. -Student shifts successfully from one structure to another.	-Student most of the times expresses ideas with ease by including studied structures -Student most of the times shifts successfully from one structure to another.	-Student occasionally expresses ideas fairly well but some mistakes on the use studied structures. -Student occasionally shifts successfully from one structure to another.	Student rarely expresses ideas adequately, and shows inconsistencies on the use of studied structures. -Student has a hard time shifting from one structure to another.	Student is not able to communicate properly because of serious grammar mistakes and absence of tense shift.
Vocabulary	-Student is able to go beyond by using a rich and precise range of vocabulary related to machine parts, tools, and new technologies. -There is appropriate use of sequencers, linking words, synonyms, and antonyms.	- Student is most of the time able to use an appropriate range of vocabulary related to machine parts, tools, and new technologies - There is some use linking words, synonyms, antonyms, and sequencers, but does not show full command of these lexical items to elaborate on complex subject descriptions.	-Student is sometimes able to use vocabulary words related to machine parts, tools, and new technologies as well as linking words, synonyms, antonyms, and sequencers. However, doubtingness and repetitiveness hinder him/her from expanding on the ideas.	-Student displays simple and basic command of vocabulary related to machine parts, tools, and new technologies as well as linking words, synonyms, antonyms, and sequencers -Communication and expansion of ideas is highly hindered.	Student shows an inadequate and inaccurate command of vocabulary related to machine parts, tools, and new technologies as well as linking words, synonyms, antonyms, and sequencers which totally hinders communication and elaboration of ideas.
Content	Student's descriptions are clear and detailed for the project and go beyond expected.	Student most of the time offers clear descriptions for the project, but does not consistently go beyond expected.	Student partially elaborates on details required for the project and does not go beyond as ideas are connected in a simple way.	Student barely elaborates on the details required for the project.	Student does not address the content expected for the project.
Pronunciation & intonation	-Pronunciation of /th/ sound, –ed and –s endings is correct, as well as the contrast between /i/ and /I/. Intonation of –wh and yes/no questions is clear and natural. -Listener is able to fully understand the message.	-Pronunciation of /th/ sound, –ed and –s endings is usually correct, as well as the contrast between /i/ and /I/. Intonation of –wh and yes/no questions is usually clear and natural. -Listener is able to understand almost all the message.	-Pronunciation of /th/ sound, –ed and –s endings is sometimes correct, as well as the contrast between /i/ and /I/. Intonation of –wh and yes/no questions is sometimes clear and natural to allow the listener to understand almost all the message.	-Pronunciation of /th/ sound, –ed and –s endings is not clear most of the time, as well as the contrast between /i/ and /I/. Intonation of –wh and yes/no questions is not completely clear. -Listener's understanding of the message gets highly hindered.	-Pronunciation of /th/ sound, –ed and –s endings is not clear, as well as the contrast between /i/ and /I/. Intonation of –wh and yes/no questions is unclear as well. -Listener's understanding of the message is hindered.
Fluency	Production of speech is effortless and with a natural speed. No hesitation or breakdowns are present.	Production of speech is smooth, but little hesitation appears causing rephrasing and minor breakdowns in communication.	Production of speech is affected by some hesitation causing moderate breakdowns in communication.	Production of speech is affected by significant amounts of hesitation and creates important breakdowns in communication.	Production of speech is highly hindered by hesitation and student stumbles and looks uncertain in the development of the responses.

SECTION II: Instructions: Mark YES or NO for each of the statements below about what the student can or cannot do based on his/her oral presentation.

		YES	NO
Independent level of performance	Can give a prepared presentation on a familiar topic within his/her field, outlining similarities and differences (e.g. between products, countries/regions, plans).		
	Can give a prepared straightforward presentation on a familiar topic within his/her field which is clear enough to be followed without difficulty most of the time.		
	Can give a clear, prepared presentation, giving reasons in support of or against a particular point of view and giving the advantages and disadvantages of various options.		
	Can give a clear, systematically developed presentation, with highlighting of significant points, and relevant supporting detail.		

If you marked YES for all the statements above, continue with to the next section. <u>Otherwise, stop here.</u>

		YES	NO
Proficient level of performance	Can give instructions on carrying out a series of complex professional or academic procedures.		
	Can give a clear, well-structured presentation of a complex subject, expanding and supporting points of view at some length with subsidiary points, reasons and relevant examples.		

Can-do statements adapted from Common European Framework of Reference for Language's Companion Volume with New Descriptors
Taken from https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989

Appendix Y. Writing Performance (Individual)

Engineering your English

Research Instrument
Writing Performance Individual
Coto & Rojas

Instructions: Put a check on the boxes that indicate the type of errors that were found in the writing task, and write examples of utterances that illustrate the errors.

Student's name:

							Examples
Grammar Errors	First conditional to describe consequences of processes and procedures		Simple present to describe facts		Passive voice in present to describe processes, machine uses, and procedures.		
	Indirect questions to formally request info		Simple past to describe completed processes		Passive voice in past to describe completed processes		
	Imperatives to describe steps		Simple future to describe action plans projects		Passive voice to describe projects to be designed		
	Infinitives to describe purposes of machines and tools		Modal verbs for possibility		Other_______________		
Vocabulary Errors	Linking words		Wrong use of vocabulary related to		Machine parts and tools		
	Synonyms				New technologies		
	Antonyms				Functions		
	Sequencers				Agreeing and disagreeing		
Mechanics Errors	Comma to separate items in a list		Run-on sentences				
	Periods at the end of sentences		Fragments				
	Capitalization		Other				
	Spelling						
Strengths							

Appendix Z. Speaking Performance (Individual)

Engineering your English

Research Instrument
Speaking Performance Individual
Coto & Rojas

Instructions: Put a check on the boxes that indicate the type of errors found in the speaking task, and write examples of utterances that illustrate the errors.

Student's name:

Task: Project Oral Presentation

							Examples
Grammar Errors	First conditional to describe consequences of processes and procedures		Simple present to describe facts		Passive voice in present to describe processes, machine uses, and procedures.		
	Indirect questions to formally request info		Simple past to describe completed processes		Passive voice in past to describe completed processes		
	Imperatives to describe steps		Simple future to describe action plans projects		Passive voice to describe projects to be designed		
	Infinitives to describe purposes of machines and tools		Modal verbs for possibility		Other_______________		
Vocabulary Errors	Linking words		Wrong use of vocabulary related to		Machine parts and tools		
	Synonyms				New technologies		
	Antonyms				Functions		
	Sequencers				Agreeing and disagreeing		
Pronunciation Errors	~ed endings		Thought groups		Mispronunciation of vocabulary studied in class		
	~es endings in plurals		Intonation of Y/N Qs				
	/th/ sound		Intonation of WH Qs				
	/i/ vs /I/		Reduced form of "to"				
Strengths							

Appendix AA. Writing Summary

Engineering your English

Research Instrument
Writing Summary
Coto & Rojas

Instructions: Indicate the number of students who made each of the errors, and write examples of utterances that illustrate the errors.

Writing Tasks

		# of sts with error		# of sts with error		# of sts with error	Most common Errors
Grammar Errors	First conditional to describe consequences of processes and procedures		Simple present to describe facts		Passive voice in present to describe processes, machine uses, and procedures.		
	Indirect questions to formally request info		Simple past to describe completed processes		Passive voice in past to describe completed processes		
	Imperatives to describe steps		Simple future to describe action plans projects		Passive voice to describe projects to be designed		
	Infinitives to describe purposes of machines and tools		Modal verbs for possibility		Other_______________		
Vocabulary Errors	Linking words		Wrong use of vocabulary related to		Machine parts and tools		
	Synonyms				New technologies		
	Antonyms				Functions		
	Sequencers				Agreeing and disagreeing		
Mechanics Errors	Comma to separate items in a list		Run-on sentences				
	Periods at the end of sentences		Fragments				
	Capitalization		Other				
	Spelling						
Strenghts							

Appendix BB. Speaking Summary.

Engineering your English

Research Instrument
Speaking Summary
Coto & Rojas

Instructions: Indicate the number of students who made each of the errors, and write examples of utterances that illustrate the errors.

Task: Project Oral Presentation

		# of sts with error		# of sts with error		# of sts with error	Most common Errors
Grammar Errors	First conditional to describe consequences of processes and procedures		Simple present to describe facts		Passive voice in present to describe processes, machine uses, and procedures.		
	Indirect questions to formally request info		Simple past to describe completed processes		Passive voice in past to describe completed processes		
	Imperatives to describe steps		Simple future to describe action plans projects		Passive voice to describe projects to be designed		
	Infinitives to describe purposes of machines and tools		Modal verbs for possibility		Other_______________		
Vocabulary Errors	Linking words		Wrong use of vocabulary related to		Machine parts and tools		
	Synonyms				New technologies		
	Antonyms				Functions		
	Sequencers				Agreeing and disagreeing		
Pronunciation Errors	~ed endings		Thought groups		Mispronunciation of vocabulary studied in class		
	~es endings in plurals		Intonation of Y/N Qs				
	/th/ sound		Intonation of WH Qs				
	/i/ vs /I/		Reduced form of "to"				
Strengths							

Appendix CC. Overall Results.

Engineering your English

Research Instrument
Overall Results
Coto & Rojas

Instructions: Analyze the data collected in the writing and speaking group summaries and complete the chart.

Productive Skills Overall Results

Grammar errors made by 50% or more of the students	Grammar Strengths
Vocabulary errors made by 50% or more of the students	Vocabulary Strengths
Mechanics errors made by 50% or more of the students	Mechanics Strengths
Pronunciation errors made by 50% or more of the students	Pronunciation Strengths

Appendix DD. Unit 1 Lesson Plans and Materials

Date: August 12th. Lesson Plan 1 & 2.
Student teacher: Garyan Rojas.
Assistant: Laura Coto.
Unit 1: Expanding your Knowledge

1. **Unit Goal:** By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies
2. **General Objective:** Accurately identify the meaning of general mechanical engineering vocabulary by guessing from the context of written texts about general mechanical engineering topics.

Specific objectives: By the end of the lesson, students will be able to:

1. Describe words by following specifications for its description by talking to a partner.
2. Explain their challenges when reading mechanical engineering texts in English by answering some questions.
3. Distinguish what context clues are about in a text by identifying their definitions and some examples of their application.
4. Differentiate context clues given in small sample texts by analyzing the context of different word.
5. Recognize meaning of words from context by applying their knowledge of context clues.
6. Identify the correct use of simple present and passive voice in the present by checking their use in texts.
7. Correctly pronounce regular past participle verbs by completing a voice recording exercise.

Obj.	Procedures	Language	Strategies	Macro Skills	Time
	Course introduction and icebreaker: Course teachers and students introduce themselves and share a little bit about themselves (likes, dislikes, etc.) Community builder: the human knot make a circle. They will hold hands with somebody who is not next to them. Then, they undo the "human knot". T and Ss reflect on the importance of team work and support during the course. Ss and T go over the course syllabus.				25
1	**Warm-up:** Ss stand up and play a guessing game in groups of three people. (GT: color gears). They take turns describing 10 words projected, but with the following indications: saying an opposite, a synonym, a definition, or an example. When a word is guessed, team yells "stop!"	Useful language: This word is the opposite of_____. It is used as a synonym for______.	Exchanging oral information	S L	10

		A______ is an example of______. This word means_________. _____ (antonym with negative prefix) is the opposite of…			
2	**Pre-task 1:** -Ss discuss the following questions with the person next to them? A. In the previous game, what was the most challenging way to describe the words? Was it to give a definition, think about a synonym or antonym, or provide an example? Sts rank them from 1 being the easiest and 4 the most difficult. C. How can prefixes help you with opposites? B. When you read a text in English, how do try to get the meaning of words you don't know? What strategy works best for you? -Introduce the concept of context clues to get meaning from context by having a volunteer read it.	Useful language: In my case, it was more challenging to provide a/an _____ because… I find providing_______difficult because… When I read, I normally_____ because… The strategy that works best for me when figuring out the meaning of words is______ because...	Turn-taking Exchanging information	S L	10 5

3	**Pre-task 2:** - Ss are presented with the idea that there are different context clues. Ss stand up, get in pairs (GT: numbers from 1 to 10) and in the handout with a concept map write the definition of each context clue that will be taped on the walls. Handout 1. -Ss complete part II of the handout by matching examples of context clues.	Useful language to check matching exercise: ___ matches ____ because it expresses a similar meaning. This is an antonym because it contrasts the meaning of_____. This is an______ because it is set off by commas. This is a _______ because the verb “is” defines the previous word. This is an______ because the phrase “such as” is used.	Using graphic organizers Matching	R W S L	10 10
4	**Pre-task 3:** -In pairs, Ss read short excerpts from mechanical engineering texts and indicate what context clue helps them get the meaning of words from context in each excerpt and explain why. Handout 2.	I used _____ because it helps to… ___ is used more because… ___ means ____because...	Identifying Agreeing Disagreeing	R W S L	20

		____ is useful because it defines… This clue explains that _____ Here is mentioned that … Here it is explained that			
5	**Task**: -Ss are given a text about cooling systems (handout 3) and read it individually. They will underline words that they do not understand well and apply the necessary context clues that can help them figure out what the word refers to. Planning: Ss will tally in a small handout how many times they used each of the context clues strategies they learned about. Handout 4. Reporting. In pairs, Ss tell each other what context clues they were able to identify. Then, some ideas are shared as a whole class.	Useful language for the reporting section: When I was reading this section, I noticed that there was a/an____ and it helped me realize that the word meant_______. After reading this idea, I noticed that… The context clue that I recognized more easily was_____ because…	Getting meaning from context	R W S L	25 10 15

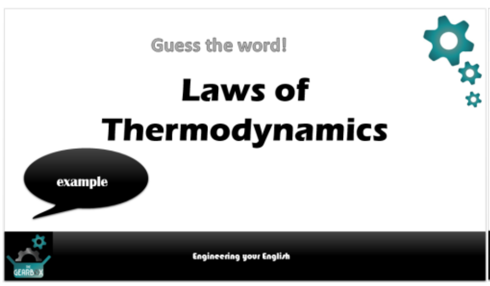
		It was not able to identify any______.			
6 7	**Post-task** Language focus: In pairs, Ss go back to the materials used before and underline some sentences in the simple present and circle examples of passive voice in the present, which is the target language of the class. Analysis: Three examples for each tense, starting with simple present, are projected and T elicits from Ss to analyze them in terms of form, meaning and use. -Ss attention is addressed to the regular past participle verbs in the passive voice examples and rules for pronunciation are explained.	Simple present examples: -This new gadget represents a huge step for humanity. -The system consists of a pneumatic piston, quick action valves and a sensing unit. -Possible asymmetries result in different effective forces. Passive voice example: -The robot controller is programmed to perform a reaching task with a handle. -The transmissibility for this system is defined as the equipment excitation over the support excitation. -Cooling systems are employed in automobiles.	Identifying examples	L S R W	5 10 10

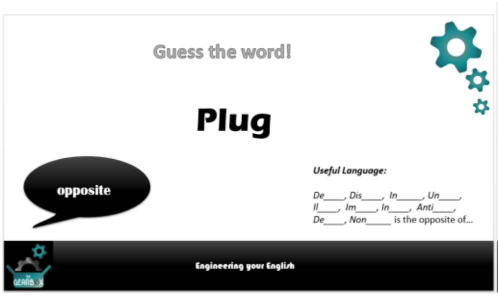
	Practice: -Ss complete handout 5, with exercises on the verb tenses. Answers are compared with the person next to them. -Ss do a voice recording exercise to practice the pronunciation of the –ed endings in sentences which will be submitted to the teachers for feedback. Handout 6.	Useful language for practice section: What did you write in number__? We have the same answer. We have a different answer here. Why? Why did you write_____ here?	Self-monitoring		10 5

Abbreviations to be used: T = teacher A = assistant Ss = students L = listening S = speaking R = reading W = writing
Others: GT: grouping technique

Material 1: Words to guess for warm-up activity:

Slides projected on the board:

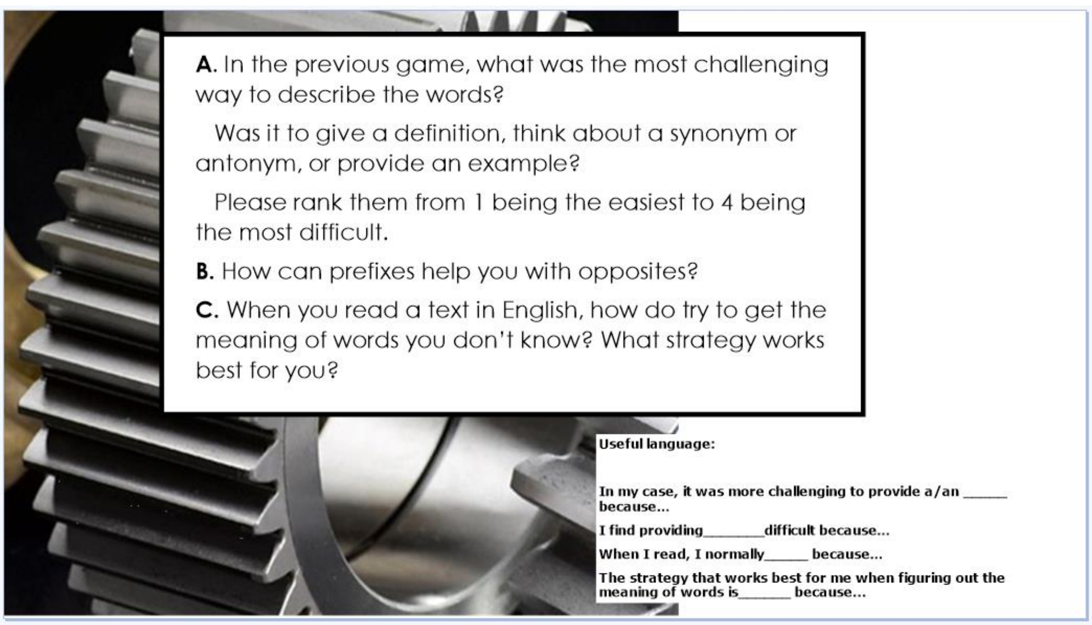




Warm-up answer key:

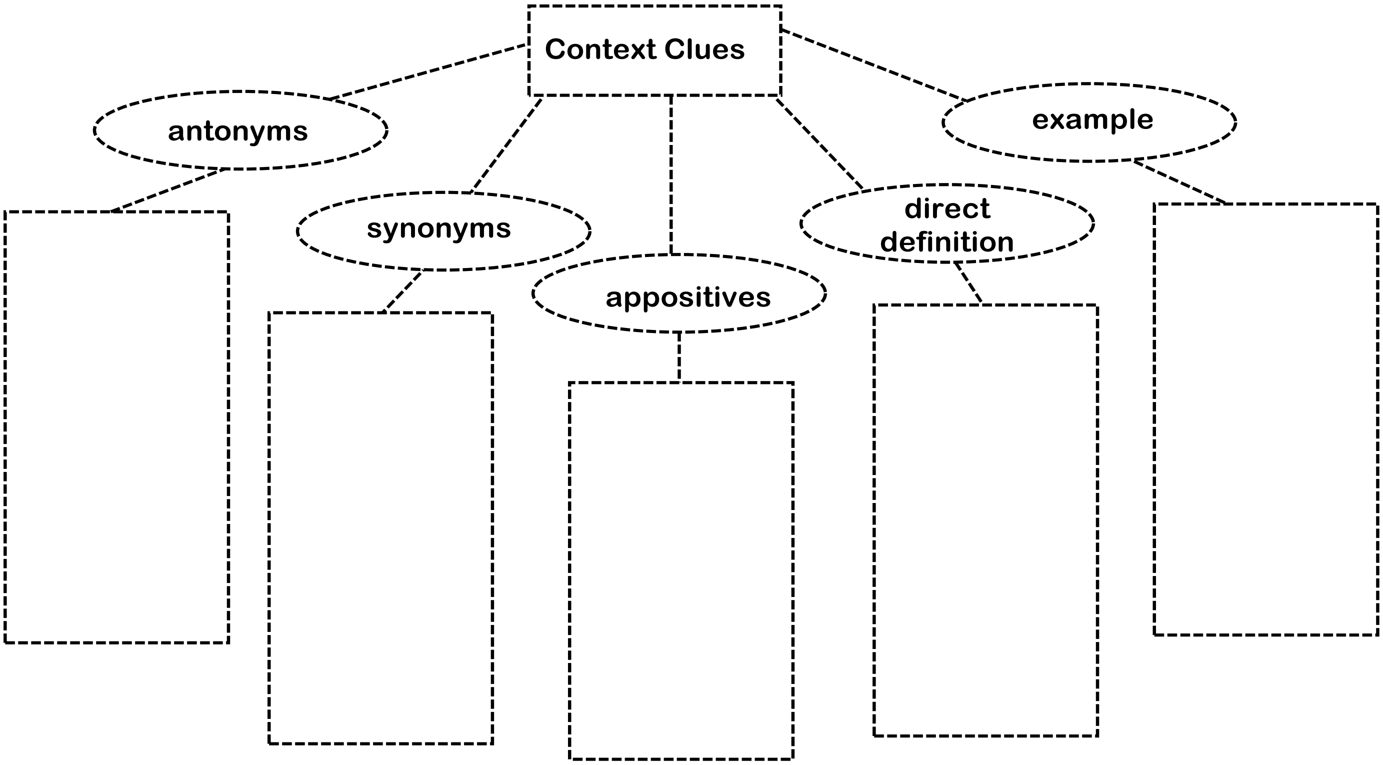
Word	Describe it using:	Possible answers
Accelerometer	Definition	An electromechanical transducer used to measure acceleration.
Adhesion	Synonym	Adherence, bond.
To burnish	Synonym	To smooth or polish
To assemble	Opposite	Disassemble
Laws of thermodynamics	Example	Law of conservation of energy. The entropy of any isolated system always increases. The entropy of a system approaches a constant value as the temperature approaches absolute zero.
DNS	Definition	Direct numerical simulation
Fuel	Example	Diesel, gasoline.
Controller	Synonym	Control system
Plug	Opposite	Unplug
Caterpillar	Definition	A vehicle that "lays its own road" by running on endless belts.

Material 2: sample slide for discussion questions.



Handout 1.

Part I. Instructions: Walk around the class and write the definition of each context clue where it corresponds.



Part II. Instructions: Match the words from the left to the ideas on the right. Then, on the blank indicate the context clue that applies. (CC=Context clue)

1. Increase
2. Motor
3. Idler
4. Device
5. Deterioration

____ An ______________ is a gear used between a driver and a follower to maintain the direction of rotation. (CC:____________________________)

____ This new gadget represents a huge step for humanity in the search of alternative ways to produce energy. (CC:____________________________)

____ The flow of diesel in the pipes is expected to __________ after the first experiment, and then decrease with the installation of the second valve. (CC:____________________________)

____ A significant degradation is visible in these gears. (CC:____________________________)

____ This is an air engine, or air __________that has a reciprocating or rotary design and whose energy source is compressed air. (CC:____________________________)

Material 2. Context clues definitions.

Synonyms	Through this context clue, the reader discovers the meaning of an unknown word because it repeats an idea but expressed in similar words that are nearby. These are words with the same meaning.
Antonyms	These are used to express opposite meanings. An opposite meaning context clue contrasts the meaning of an unfamiliar word with the meaning of a familiar one.
Appositives	They are nouns or noun phrases that define or restate another noun. They follow the word they define and are set off by commas.
Direct definition	A new concept is formally defined or the reader encounters a sufficient explanation within the sentence. You can pay attention to words like: "that is", and parenthesis ( ).
Example	Sometimes a new word is surrounded by something that illustrates it nearby to explain its meaning. The phrase "such as" is used to introduce this context clue.

Adapted from: http://www.mdc.edu/kendall/collegeprep/documents2/context%20cluesrev8192.pdf

https://www.grammar.com/appositive

Part II Answer key.

Increase	1
Motor	2
Idler	3
Device	4
Deterioration	5

3	An _______________ is a gear used between a driver and a follower to maintain the direction of rotation. (CC: definition)
4	This new gadget represents a huge step for humanity in the search of alternative ways to produce energy. (CC: synonym)
1	The flow of diesel in the pipes is expected to ___________ after the first experiment, and then decrease with the installation of the second valve. (CC: antonym)
5	Significant degradation such as rust is visible in these gears. (CC: example)
2	This is an air engine, or air ___________, which has a reciprocating or rotary design and whose energy source is compressed air. (CC: appositive)

Handout 2.

Instructions: Read the following excerpts from mechanical engineering texts and write the name of the context clue you identify and that you used to clarify sections of the sentences. Underline the section that you focused on.

Text excerpt	Context clue
1.In a real roller coaster there are cement or concrete footers that hold the support structures.	
2.First, the robot controller is programmed to perform a reaching task with a handle. "The robot's motor predicts its reaching motion—how far the handle will move—because it knows how much input to the motor will create that motion," Li said.	
3.These appendages are folded up for launch and are meant to unfold after they reach space. But once every two or three years, an antenna or solar panel does not deploy properly—and a mission costing hundreds of millions of dollars comes to naught.	
4.Based on the dynamical model of the flight phase, the flight controller uses a two-degrees-of-freedom control scheme consisting of a nonlinear feedforward controller with corresponding trajectory planning and an under-lying stabilizing feedback part.	
5.The pneumatic actuation system in each leg of the Bionic Kangaroo consists of a pneumatic piston, quick action valves in 5=3configuration and a sensing unit for measuring the pressure pi in the upper piston chambers of both legs iAf1; 2g. At the start of a new hopping cycle, the pneumatic actuators are used to provide energy for the take-off (in addition to the potential energy stored in the elastic tendon). In general, however, possible asymmetries in the setup (kinematics, springs, pneumatics) result in different effective forces in both legs that generate a torque about the longitudinal axis of the Bionic Kangaroo leading to the above-mentioned roll dynamics.	
6.The transmissibility for this system is defined as the equipment excitation over the support excitation. However, if the equipment is excited by the force (F), then the transmissibility is defined as the force transmitted (FT) to the base over the force applied to the equipment. If the system is linear these transmissibilities are equivalent.	
7.The limitations described in Section 2.3 are alleviated by increasing the complexity of the system, i.e. by adding more degrees of freedom.	
8.Transportation systems that aren't continuously connected to electric rails or overhead wires (as trains and streetcars are) need to bring their own energy source with them. Such vehicles need an onboard storage device and a powerblock—a fuel tank and an internal combustion engine for a conventional car, or a battery and a motor for an electric vehicle.	

Excerpts taken from:

- https://www.asme.org/engineering-topics/articles/robotics/game-theory-helps-robot-design
- https://www.asme.org/engineering-topics/articles/manufacturing-design/thrills-from-cedar-point-rides
- Orbital Mechanics, by Gordon Roesler, Paul Jaffe, & Glenn Henshaw
- Control design for a bionic kangaroo. By Knut Graichen, Sebastian Hentzelt, Alexander Hildebrandt, Nadine Kärcher, Nina Gaißert and Elias Knubben.
- Comparison of single- and two-degree-of-freedom models for passive and active vibration isolation design. By Dino Sciulli, Daniel J. Inman.
- http://memagazineselect.asmedigitalcollection.org/article.aspx?articleid=2736091

Handout 2. Answer key

Text excerpt	Context clue
In a real roller coaster there are cement or concrete footers that hold the support structures.	Synonym
First, the robot controller is programmed to perform a reaching task with a handle. “The robot’s motor predicts its reaching motion—how far the handle will move—because it knows how much input to the motor will create that motion,” Li said.	Appositive
These appendages are folded up for launch and are meant to unfold after they reach space. But once every two or three years, an antenna or solar panel does not deploy properly—and a mission costing hundreds of millions of dollars comes to naught.	Antonym
Based on the dynamical model of the flight phase, the flight controller uses a two-degrees-of-freedom control scheme consisting of a nonlinear feedforward controller with corresponding trajectory planning and an under-lying stabilizing feedback part.	Definition
The pneumatic actuation system in each leg of the Bionic Kangaroo consists of a pneumatic piston, quick action valves in 5=3configuration and a sensing unit for measuring the pressure pi in the upper piston chambers of both legs iAf1; 2g. At the start of a new hopping cycle, the pneumatic actuators are used to provide energy for the take-off (in addition to the potential energy stored in the elastic tendon). In general, however, possible asymmetries in the setup (kinematics, springs, pneumatics) result in different effective forces in both legs that generate a torque about the longitudinal axis of the Bionic Kangaroo leading to the above-mentioned roll dynamics.	Examples
The transmissibility for this system is defined as the equipment excitation over the support excitation. However, if the equipment is excited by the force (F), then the transmissibility is defined as the force transmitted (FT) to the base over the force applied to the equipment. If the system is linear these transmissibilities are equivalent.	Definition
The limitations described in Section 2.3 are alleviated by increasing the complexity of the system, i.e. by adding more degrees of freedom.	Example
Transportation systems that aren’t continuously connected to electric rails or overhead wires (as trains and streetcars are) need to bring their own energy source with them. Such vehicles need an onboard storage device and a powerblock, a fuel tank or a battery, to function properly.	Example Appositive

Handout 3.

Instructions: Imagine one of your professors assigned a reading homework for tomorrow. Underline the words or phrases you do not understand and apply the necessary context clue to get their meaning from context.

Cooling Systems

By: The Editors of Encyclopedia Britannica.

Cooling system, apparatus employed to keep the temperature of a structure or device from exceeding limits imposed by needs of safety and efficiency. If overheated, the oil in a mechanical transmission loses its lubricating capacity, while the fluid in a hydraulic coupling or converter leaks under the pressure created. In an electric motor, overheating causes deterioration or degradation of the insulation. The pistons in an overheated internal-combustion engine may seize (stick) in the cylinders. Cooling systems are employed in automobiles, industrial plant machinery, nuclear reactors, and many other types of machinery. (For a treatment of cooling systems used in buildings, see air-conditioning.

The cooling agents customarily employed are air and a liquid (usually water or a solution of water and antifreeze), either alone or in combination. In some cases, direct contact with ambient air (free convection) may be sufficient; in other cases, it may be necessary to employ forced-air convection, created either by a fan or by the natural motion of the hot body. Liquid is typically moved through a continuous loop in the cooling system by a pump.

In a transmission, if the surface area of the housing (container) is sufficiently large compared with the power lost, or if the transmission is in a moving vehicle, there is usually adequate free convection and no need for artificial cooling. To augment the cooling effect by increasing the surface area, the housing may be provided with thin metal fins. On some stationary mechanical transmissions, it may be necessary to circulate the lubricating oil through pipes surrounded by cold water or to use a fan to blow air through pipes surrounded by the oil in the reservoir. On many electric motors, a fan is attached to the rotating element to create a current of cooling air through the housing.

In an automobile, the motion of the vehicle provides sufficient forced-convection cooling for the transmission and the gears in the rear axle; in the engine, however, so much energy is released that, except for some early models and certain small cars with low-powered engines, air cooling is inadequate, and a water cooling system (radiator) is required.

A typical automotive cooling system comprises (1) a series of channels cast into the engine block and cylinder head, surrounding the combustion chambers with circulating liquid to carry away heat; (2) a radiator, consisting of many small tubes equipped with a honeycomb of fins to convect heat rapidly, that receives and cools hot liquid from the engine; (3) a water pump, usually of the centrifugal type, to circulate the liquid through the system; (4) a thermostat to control temperature by varying the amount of liquid going to the radiator; and (5) a fan to draw fresh air through the radiator.To prevent freezing, an antifreeze solution is either added to or substituted for water. To raise the boiling point of the solution, the cooling system is usually pressurized by means of a pressure cap on the radiator with valves that open outwardly at a prescribed pressure and inwardly to prevent a vacuum as the system cools.

Handout 4.

Instructions: Tally the number of times you used the different context clues as you read the text about cooling systems.

Synonyms	Antonyms	Appositives	Direct definitions	Examples

Useful language:

- When I was reading this section, I noticed that there was a/an____ and it helped me realize that the word/idea meant…
- After reading this idea, I noticed that…
- The context clue that I recognized more easily was_____ because…
- It was not able to identify any____ in the text.

Handout 5.

Grammar exercises.

Part 1. Simple Present. Read the following sentences and circle the verb form that best complete the ideas.

1. That way the train (combine / combines) the energy storage benefits of diesel with the high torque and ease of control of an electric motor.
2. This actually (understates / understate) the number of jobs in the firm.
3. Small rotorcraft unmanned air vehicles (sUAVs) (is / are) valuable tools in solving geospatial inspection challenges.
4. The boss usually (provides / provide) a contact surface around the hole.
5. An air compressor (are / is) a turbomachine that draws / draw) in air and (deliver / delivers) it at higher pressure, temperature, and density.
6. The afterfilter (remove / removes) fine solid particles and liquid droplets from the flow.

Part 2. Passive voice. Complete the sentences with the correct form of the verb in parentheses using passive voice in the present.

1. Suspended solids and other impurities_______________________ (retain) within the basin while flow equalization manages the liquid level throughout the system.
2. The Bio-Kinetic wastewater management systems _______________________ (back) by a comprehensive ten-year limited warranty.
3. A cam, a mechanical device consisting of an eccentric or multiply curved wheel mounted on a rotating shaft, _______________________ (use) to produce variable or reciprocating motion in another engaged or contacted part.
4. The relations between the components _______________________ (show) by connecting lines.
5. The deflection of an elastic body at the point of application of an external load _______________________ (give) by the partial derivative of the strain energy.
6. A special solution _______________________ (add) to prevent overheating of the machine parts.

Sources:

Dictionary of Mechanical Engineering.

www. asme.org

Handout 5. Answer key.

Part 1.

1. That way the train (combine / **combine**) the energy storage benefits of diesel with the high torque and ease of control of an electric motor.
2. This actually (u**nderstates** / understate) the number of jobs in the firm.
3. Small rotorcraft unmanned air vehicles (sUAVs) (is / **are**) valuable tools in solving geospatial inspection challenges.
4. The boss usually (**provides** / provide) a contact surface around the hole.
5. An air compressor (are / **is**) a turbomachine that (**draws** / draw) in air and (deliver / **delivers**) it at higher pressure, temperature, and density.
6. The afterfilters (**remove** / removes) fine solid particles and liquid droplets from the flow.

Part 2.

1. Suspended solids and other impurities **are retained** within the basin while flow equalization manages the liquid level throughout the system.
2. The Bio-Kinetic wastewater management systems **are backed** by a comprehensive ten-year limited warranty.
3. A cam, a mechanical device consisting of an eccentric or multiply curved wheel mounted on a rotating shaft, **is used** to produce variable or reciprocating motion in another engaged or contacted part.
4. The relations between the components **are shown** by connecting lines.
5. The deflection of an elastic body at the point of application of an external load **is given** by the partial derivative of the strain energy.
6. A special solution **is added** to prevent overheating of the machine parts.

Handout 6.

Instructions. Record the following sentences on your cellphone as you pay special attention to the pronunciation of regular verbs studied before. When you are ready, please submit your recording to engi.english.ucr@gmail.com. You will receive feedback from the teachers.

1. The clevis is **used** as a fastening device which allows rotational motion.
2. Accuracy in machine parts is **determined** through a gage.
3. Temperature is **controlled** through the thermostat.
4. A fifty-fifty ratio of antifreeze and water is **recommended** in automobile engines.
5. Fans keep air flowing through the radiator when the vehicle is **stopped** with the engine running.

Date: August 26th, 2019.
Teacher in charge: Laura Coto
Assistant: Garyan Rojas
Lesson plan # 3.

Unit 1: Expanding your Knowledge

1. **Unit Goal:** By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies.

2. **General Objective:** Successfully identify the main ideas and details in sample texts about new technologies by using skimming and scanning strategies.

Specific objectives: By the end of the lesson, students will be able to:

1. Accurately pronounce words related to machine parts, tools and new technologies.
2. Recognize the need of learning strategies that allow better and faster grasping of general ideas and details.
3. Apply skimming strategies in short texts about new technologies in order to find general ideas.
4. Apply scanning strategies in short texts about new technologies in order to find specific details.
5. Apply skimming and scanning strategies in medium-length texts about new technologies in order to identify main ideas and details requested.
6. Accurately locate general ideas and details of a long text with more complex vocabulary about new technologies through the application of skimming and scanning strategies.
7. Identify the simple present in active and passive voice in written texts about new technologies.
8. Identify the correct pronunciation of regular past participle verbs.

Obj.	Procedures	Language	Strategies	Macro Skills	Time alloted
1	**Warm-up:** Pronunciation practice with vocabulary recycled from previous lesson.	**Task language:** Alphabet for spelling, **Interaction language:**		S	10

	Each student gets a glossary with 3 pronunciation sections, each containing different words. Students work in pairs to practice the pronunciation of the words in one of the sections using the question prompt provided. (Each student works in a different section). They can spell the words if necessary. Pronunciation of the 3 sections is then reviewed with the whole class.	*I start / You start.* *What's the meaning of…?* *How do you pronounce….?* *What is the pronunciation of…?* *Can you repeat it, please?* *How do you spell that?* *It's spelled…* *The first word is pronounced...* *The second word is spelled...*	Asking for clarification	L	
2	**Pre-task 1:** As a review and follow up for last class' activity, (pre-task # 1 fully done previous class) in pairs sts match skimming and scanning with their definition and application using the projection in the board.	**Task language:** Simple present in active and passive voice **Interaction language:** *If I am not wrong, skimming is used when…* *As far as I remember, scanning is used when….* *I think scanning is…….* *Definition A corresponds to scanning.* *Skimming is useful for…*	Skimming and scanning	R W S L	5

3	**Pre-task 2:** Sts work with handout # 2 to read the main ideas of paragraphs. They then walk around the class and match the main ideas with the corresponding paragraph by applying skimming. Once ready, sts compare answers in pairs and then check answers as a whole class.	**Task language:** Simple present in active and passive voice. Nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *What is the main idea in paragraph # _?* *This is the main idea for paragraph _____.* *I agree/disagree with you because the paragraph says that…* *What strategy did you apply to find the main ideas?*	Skimming	R S L	15
4	**Pre-task 3:** Sts work in handout # 3 to complete the text with the missing words using the word bank provided. They are encouraged to apply scanning. Sts compare answers in pairs and then with the teacher as a whole class.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language** ____ *goes here.*	Scanning	R W L S	15

		The best option for # ___ is ____ because... *What do you think goes in # ____?* *In this part ____ is the correct word.* *Where do you think ____ goes?*			
5	**Pre-task 4:** A,Sts get a handout with a list of words which they need to find in the text used last class (pre-task # 1 lesson #2). The activity will be allotted only 5 minutes so that sts are forced to individually apply scanning and spot the words. All words are related to machine parts and tools and were chosen in order to review and recycle them. Once done they compare answers in pairs. **B.** Stations: In pairs, sts move around the stations. Each station will contain questions about the previous text and a blank sheet of paper. They will write the answers in the paper and will fold it so that the next group can't see the answer they wrote. They then move to another station and repeat the process. Papers will end up like a Chinese fan will all groups' answers. In pairs, sts will take one of the sheets and will analyze how answers provided by different groups are similar or different. Handout # 4.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *Did you find all the words?* *Let's compare.* *Where is…?* ********** *What do you think is the answer to this question? Why?* *I agree/disagree because the text says that…* *I believe / think* *****************	Skimming and scanning	R W S L	5 15

		The answers are similar / different / somehow similar because… *This is similar to ___* *This is different from_____*			
6	**Task**: *Apply skimming and scanning strategies to complete charts with main ideas and details of scientific articles about new technologies.* Individually, sts are given a chart with questions and information they need to complete based on the text. They check the information carefully and then read an article in the time allotted (15min). Once they finish reading, they complete the exercises in handout # 5. <u>Planning</u>: For each of the exercises or questions in the handouts, sts identify the strategy that they used in order to answer each of the questions. <u>Reporting:</u> Sts get in pairs and compare answers and their use of strategies while reading. They then share answers with the whole group.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *What strategy did you apply to answer section A / B / C?* *For section ____I applied_____(strategy) because…* *What is the correct answer to # _____ in section_____?* *In my case, skimming/scanning was useful because…*	Skimming Scanning	R S W L	15 5 10

7	**Post-task** <u>Language focus:</u> In pairs, sts copy in handout # 6 the highlighted phrases from the handouts previously used. They analyze the commonalities in each column and the use of simple present in active and passive voice is elicited, addressed, and reviewed. Handout # 6	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools.	Identifying examples and patterns	R W S	15
	<u>Practice:</u> In pairs, sts unscramble sentences given in an envelope. They will contain sentences in simple present in active and passive voice. Answers are checked. Handout # 7	**Interaction language:** *It seems to me that this sentence goes like this because...*			10
	Sts mark the correct pronunciation for the participles using handout # 8.	*I remember the order is first the subject and then the verb.*			
8	Speaking practice: sts work in groups of three and discuss the opinion questions projected on the board which are related to the text about gas turbines.	*What do you think about this order?* *Do you agree with the organization of this sentence?*			10
	HW: A. Find the glossary words in the texts used today and last class. Circle them and study the definition in the glossary within the context it appears. **B.** Send a recording with your pronunciation of the words in the glossary.				10

Abbreviations to be used: T = teacher A = assistant Ss = students L = listening S = speaking R = reading W

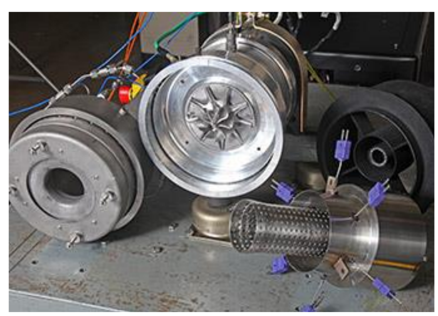
Handout 1

Unique Gas Turbine Engine Powers Quieter, More Reliable Drones Nov 7, 2018

by Agam Shah
Associate Editor at Mechanical Engineering magazine

The earliest drones David Ransom remembers were biplanes that ran on piston engines and took off from runways. Now battery-powered quadcopters take flight vertically with relative ease. Inspired by those copters, Ransom, director of the machinery department at Southwest Research Institute, saw an opportunity to make a wider variety of unmanned aerial vehicles quieter, more reliable and able to fly longer than current engines allow.

As a result, the company built a small radial gas turbine that powers a small generator that provides thousands of hours of flight to drones. Current drone turbines typically wear out after a few hundred hours. SWRI's engine is also quieter and more durable than piston engines, and provides more flight time than battery-powered motors. The fuel-to-electric system resulted from a project that **is sponsored** by IARPA to develop an architecture for a quiet unmanned aerial vehicle.



SwRI used a specialized 3D printer that can craft layered and highly detailed metal parts to build its radial gas turbine. Image: Southwest Research Institute

SWRI's turbine makes a very high-frequency noise that humans can't hear. **It is designed** for larger drones used for surveilling different types of equipment. Drones with SWRI's turbine **are carried** around in a trailer and then ground-launched, Ransom said.

The turbine has an efficiency of 20 percent to 25 percent, which is not as good reciprocating engines, which can hit up to 50 percent. But the turbine's application calls for less noise, not more efficiency. “By and large, they're not the most efficient machines,” Ransom said. “I wouldn't think of it as a replacement, but as a new enabling combination of technologies that allows you to do quiet flight operations."

Turbines are also more expensive than piston engines, but the simplicity of their moving parts means easier maintenance. The new turbines also run cooler than small turbines that **are currently used**. **Those turbines are also constantly exposed** to high temperatures given off during the generator’s combustion process. While turbines perform better as they get hotter, they **are eventually damaged** by extreme heat.

To solve the overheating problem, SWRI used a new selective laser melting machine (SLM) to build small, intricate airflow passages inside the turbine that cool it without affecting power. The design, Ransom said, yielded a turbine that’s both reliable and high-performing. Turbines also have an advantage in remote monitoring applications, since gasoline and diesel **are transported** simply and **are found** easier than a charging station.

While even smaller micro gas turbine engines **are built** by other engineers, Ransom doesn’t think he could go any smaller with the SWRI turbine. “What happens is you **are dominated** by the clearance effects between the compressor and turbine and the housing,” he said. “So clearance starts to become quite large compared to the size of the air flow path. That's where you really start to lose efficiency. I think the designs that **are seen** right now in this class is about the smallest practical size for a gas turbine engine.”

Adapted from https://www.asme.org/topics-resources/content/unique-gas-turbine-powers-quieter-more-reliable

Part 1. Instructions: Complete the information required.

A. What type of text is this? Mark with an X in the corresponding box.

☐ A scientific report ☐ A blog ☐ A magazine article ☐ A letter

☐ An email ☐ A website journal

B. What **topic** is the text about? Mark with an X in the corresponding box.

☐ Turbines ☐ New gases ☐ Mechanical engineering magazines

☐ Drones ☐ David Ransom ☐ Unique new technologies

C. What is the main idea of the text?

____

____

____

Part 2. Instructions: Complete the information required.

A. What is David Ransom's occupation?

____

B. What are four advantages of the SWRI?

1. ____
2. ____
3. ____
4. ____

C. What are two disadvantages of the SWRI?

1. ____
2. ____

D. Why did the company build this turbine?

____

____

Answer key

<u>Part 1. Instructions:</u> Complete the information required.

D. What type of text is this?   A magazine article
E. What **<u>topic</u>** is the text about? Turbines
F. What is the main idea of the text? A new gas turbine was invented to power drones and it offers several advantages, but it also has some cons. (Answers may vary)

<u>Part 2. Instructions:</u> Complete the information required.

E. What is David Ransom's occupation? director of the machinery department at Southwest Research Institute
F. What are four advantages of the SWRI? (all options below are possible)
    1. It provides thousands of hours of flight to drones
    2. Quieter and more durable than piston engines
    3. Provides more flight time than battery-powered motors.
    4. Makes a very high-frequency noise that humans can't hear
    5. The simplicity of their moving parts means easier maintenance.
    6. Runs cooler than small turbines that are currently used
    7. Turbines perform better as they get hotter
    8. Small, intricate airflow passages inside the turbine that cool it without affecting power

G. What are two disadvantages of the SWRI? (all options below are possible)
    1. The turbine <u>has</u> an efficiency of 20 percent to 25 percent which <u>is</u> not as good reciprocating engines
    2. The turbine's application <u>calls</u> for less noise, not more efficiency.
    3. They're not the most efficient machines
    4. Turbines <u>are</u> also more expensive than piston engines
    5. They are eventually damaged by extreme heat.

H. Why did the company build this turbine?
   They saw an opportunity to make a wider variety of unmanned aerial vehicles quieter, more reliable and able to fly longer than current engines allow. (Answers may vary)

Handout 2

Instructions: Walk around the class and read the paragraphs posted on the walls. As you do so, write the number of the paragraph next to one of the main ideas below.

Text adapted from: https://www.asme.org/topics-resources/content/10-top-emerging-technologies-part-1

Main idea	Paragraph #
• The speed of 5G is so efficient that it has been used in androids that can instantly mimic a person's movements.	
• The 5G technology will be used beyond mobile devices as it is expected to be part of machines and a wide variety of equipment in order to address many of the needs humans have.	
• New and fast communication technologies now offer the possibility of interconnecting machines just as people are connected through the technology used for cellphones.	
• An automobile company is looking forward to using 5G technology in order to provide users with a more secure experience while using their vehicles.	
• The technology behind bitcoins offers possibilities for it to be used in the manufacturing and management of machines.	

Handout 2. ANSWER KEY.

Text adapted from: https://www.asme.org/topics-resources/content/10-top-emerging-technologies-part-1 (part 1)

Paragraph 1: Ingenuity and vision are the hallmarks of great engineering. Envisioning the machines of tomorrow is especially important, and some technologies – visible and invisible – could change the way we design and make products. New communication technologies will link up machines much like cellular technologies interconnecting humans. These technologies could make it common for hospitals to monitor patients as soon as they are in an ambulance, or for factories to be alerted to hazardous conditions by remote industrial control rooms. One of these critical technologies is 5G, which had a coming out party at the recent Mobile World Congress (MWC) trade show held in Barcelona. The show is largely a showcase for the newest mobile handsets, but the latest Internet of Things technologies also took the spotlight. We explore the ten top trends from the show.

Main idea: *New and fast communication technologies now offer the possibility of interconnecting machines just as people are connected through the technology used for cellphones.*

Paragraph 2:

1) Goodbye, 4G. 5G is the faster successor to 4G, and it is coming soon. By the end of 2018, AT&T will launch its 5G network for mobile devices, and soon after, it will be in machines, cars, IoT devices, drones, and infrastructure equipment. Simply explained, 5G will allow machines to make long-distance data calls to other mechanical and electrical devices at speeds faster than today's home internet connections. 5G modems were shown by Intel, Qualcomm, and Sierra Wireless, while Ericsson talked about 5G technologies for IoT devices and machines. Ubimetro boasted about a 5G connected street lamp, while Germany's Fraunhofer Institute demonstrated a 5G security camera with superfast connection to a computer so it could instantly recognize a face.

Main idea*: The 5G technology will be used beyond mobile devices as it is expected to be part of machines and a wide variety of equipment in order to address many of the needs humans have.*

Paragraph 3:

2) Blockchain. Many think blockchain is the same as bitcoin, but it isn't. Blockchain is the underlying technology that makes bitcoin possible, and it can be adapted to manufacturing. Companies like Cisco and Nokia are exploring ways to log timestamped data sent from sensors on a digital ledger – which is at the center of blockchain – and instantly verifying it as being genuine. A deeper audit trail on a blockchain could help in the effective management of sensors and machines.

Main idea: *The technology behind bitcoins offers possibilities for it to be used in the manufacturing and management of machines.*

Paragraph 4:

3) 5G Robot. NTT DoCoMo of Japan demonstrated a 5G humanoid robot "that uses 5G to mirror the operator's movements in real time and perform tasks remotely." The idea was to demonstrate the speed of 5G and how it can mimic human movement almost instantly. NTT also expects to put 5G IoT devices all over 2020 Olympics in Tokyo, so if you plan to be there, watch out.

Main idea: *The speed of 5G is so efficient that it has been used in androids that can instantly mimic a person's movements.*

Paragraph 5: 4) Augmented Identity. The concept of "augmented identity" is key to preventing future car theft. IDEMIA, a French company, wants to bring facial recognition for the authorized use of cars. Enroll your face with a system, and a car will unlock only if it recognizes your face. The technology uses sensors, location tracking, and software. IDEMIA has a larger goal of enabling a more secure shared driving culture.

Main idea: *An automobile company is looking forward to using 5G technology in order to provide users with a more secure experience while using their vehicles.*

Handout 3

Part 1. Instructions: Use the word bank to complete the texts. Use the scanning strategy.

WORD BANK

tools	security	machines	model	ensures	enables
devices	applications	protocols	transmission	equipment	
sensor	assessment	automation	technologies		

10 Emerging Technologies in Engineering Part 2

Advances from 5G to blockchain encryption.

5) **Security.** A number of IoT (1) ____________ were affected by the recent Spectre and Meltdown chip vulnerabilities, which **are considered** the mother of all hardware hacks. It's no surprise that device and chip makers are worried about (2) ___________of IoT devices, after all nobody wants hackers attacking smart medical devices and traffic signals. ARM talked about the best security practices – like threat (3) _______________ and implementation – from the perspective of smart water meters and asset tracking devices, which are common. Those models **can be exported** to other IoT devices.

6) **Smart cities.** Nokia has a new vision of how smart cities should look with new 5G, blockchain, and IoT (4) ______________. Nokia's "sensing as a service" platform provides a way to timestamp (5) _________ data, securely collect it, and monetize it via blockchain. The data (6) ____________ happens over 5G. A software layer does the grunt work of analyzing data, detecting anomalies, and making predictions. Overall, it's a new way of collecting data and transacting, especially in "video surveillance, lighting, parking, waste management, and environmental sensing," the company says.

7) **Hop-on, hop-off IoT**. Uber has demonstrated the power of a distributed workforce and independent contracting in the gig economy, and (7) __________ could join the act. Nokia's smart

city concept of "sensing as a service" virtualizes IoT, adding flexibility to how plans **are implemented** in a given service. The modular smart-city design (8) _________ operators and providers to get on to smart city initiatives without being tied to long-term engagements. As an operator, you get the contract, and Nokia will deploy the sensors, site equipment and attach it to an IoT real-time monitoring platform. Once the contract is over, Nokia takes the equipment back. Operators save on buying and installing sensors, and Nokia gets a cut of the revenue. That (9) ________ could extend beyond smart cities in the future.

8) Autonomous vehicles: No show is complete without jazzy cars that **are parked** on the floor. Autonomous cars on the MWC floor **are donned** with 5G modems and demonstrated the future of car communications. Emerging vehicle-to-vehicle communication (10) ___________ will allow cars to talk to each other, sharing weather and traffic information directly. That is already being done, but requires access to a cloud service. Companies like Telenor demonstrated autonomous cars using 5G, though more (11) ___________**are explored.**

9) **Smooth operator:** An effective diagnosis of a health condition may rely on readings from multiple medical devices. Cisco's Crosswork software-and-hardware platform (12) _________ all devices work smoothly and smartly via machine learning and other (13) ________. An interesting side feature is Health Insights, which can gather data from medical devices in an orderly fashion. Add a software intelligence layer, and you get a quick diagnosis of a disease from the readings. It's an interesting health (14) __________ tool, though not as good as a doctor's diagnosis.

10) **SIM cards in machines:** With 5G comes a new eSIM card that will enable machine-to-machine communications between devices and infrastructure (15) _____________. The eSIMs will be embedded on PCBs or CPUs, or **could be slotted** in for modularity. Able Devices demonstrated a smart traffic system operating independently with a chip and eSIM card, which has an extra security (16) ___________.

Adapted from: https://www.asme.org/topics-resources/content/10-top-emerging-technologies-part-2

Handout 4

Part 1. Instructions: Go back to the text *Unique Gas Turbine Engine Powers Quieter, More Reliable Drones* by Agam Shah. Find and circle the words in the following list. Then answer the questions below.

-Electric system	-Surveilling	-Airflow passages	-Generator
-High-frequency	-Battery-powered	-Maintenance	
-Gas turbine	-Piston	-Temperatures	-Combustion
-Engines	-IARPA	-Diesel	-Compressor
-Gasoline			

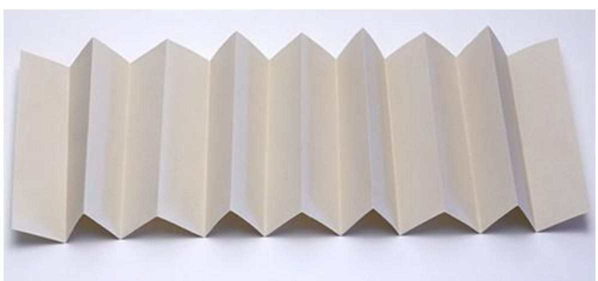
1. Did you read all the text to find those words?

 ____.

2. What strategy did you use? Why?

 ____.

Part 2. Instructions. Get in pairs. Visit the different stations and write an answer to the questions provided in the blank sheet of paper provided. Fold the paper so that the other team does not see your answer.



Questions for stations:

How does the director of the Southwest Research Institute want new aerial vehicles to be?
What feature does the radial gas turbine have and how is it different from current drone turbines?
What is the silent feature of the SWIRI turbine used for?
How efficient is the SWIRI turbine?
What's the function of the SLM in the SWRI?
Why can't the SWRI turbine be smaller?

Answer Key:

1. How does the director of the Southwest Research Institute want new aerial vehicles to be?

He saw an opportunity to make a wider variety of unmanned aerial vehicles quieter, more reliable and able to fly longer than current engines allow.

2. What feature does the radial gas turbine have and how is it different from current drone turbines?

The gas turbine powers a small generator that provides thousands of hours of flight to drones in contrast to current drone turbines which typically wear out after a few hundred hours. SWRI's engine is also quieter and more durable than piston engines, and provides more flight time than battery-powered motors.

3. What is the silent feature of the SWIRI turbine used for?

The silent feature allows for larger drones to be used for surveilling different types of equipment.

4. How efficient is the SWIRI turbine?

It is not as efficient. This turbine has an efficiency of 20 percent to 25 percent, which is not as good reciprocating engines, which can hit up to 50 percent. However, director Ransom sees it as an enabling combination of technologies that allows you to do quiet flight operations

What's the function of the SLM in the SWRI?

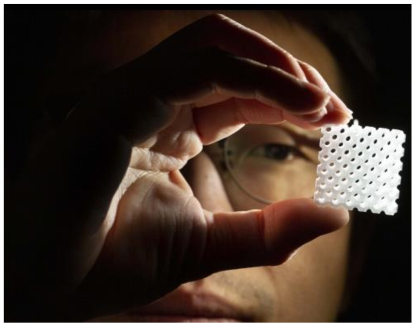
The selective laser melting machine (SLM) is used to build small, intricate airflow passages inside the turbine that cool it without affecting power.

Why can't the SWRI turbine be smaller?

According to Ransom, you are dominated by the clearance effects between the compressor and turbine and the housing. So, clearance starts to become quite large compared to the size of the air flow path. That's where you really start to lose efficiency

Handout 5

Part 1. Instructions: Read the article individually applying skimming and scanning strategies in order to answer the questions or provide the information below.



A new era in 3-D printing

Mechanical engineering researchers are inventing game-changing technologies and developing a renaissance in 3-D printing.

Mary Beth O'Leary | Department of Mechanical Engineering

May 16, 2019

In the mid-15th century, a new technology that would change the course of history was invented. Johannes Gutenberg's printing press, with its movable type, promoted the dissemination of information and ideas that **is widely recognized** as a major contributing factor for the Renaissance. Over 500 years later, a new type of printing was invented in the labs of MIT. Emanuel Sachs, professor of mechanical engineering, invented a process known as binder jet printing. In binder jet printing, an inkjet printhead selectively <u>drops</u> a liquid binder material into a powder bed — creating a three-dimensional object layer by layer.

Sachs coined a new name for this process: 3-D printing. Sachs' binder jet printing process was one of several technologies developed in the 1980s and '90s in the field now known as additive manufacturing, a term that has come to describe a wide variety of layer-based production technologies. Over the past three decades, there has been an explosion in additive manufacturing research. These technologies <u>have</u> the potential to transform the way countless products **are designed and manufactured**. One of the most immediate applications of 3-D printing has been the rapid prototyping of products. "It <u>takes</u> a long time to prototype using traditional manufacturing methods," <u>explains</u> Sachs. 3-D printing has transformed this process, enabling rapid iteration and testing during the product development process.

This flexibility has been a game-changer for designers. “You can now create dozens of designs in CAD, input them into a 3-D printer, and in a matter of hours you have all your prototypes,” adds Maria Yang, professor of mechanical engineering and director of MIT’s Ideation Laboratory.

Improving speed, cost, and accuracy

There are several technological hurdles that have prevented additive manufacturing from having an impact on the level of Gutenberg’s printing press. A. John Hart, associate professor of mechanical engineering and director of MIT’s Laboratory for Manufacturing and Productivity, focuses much of his research on addressing those issues. “One of the most important barriers to making 3-D printing accessible to designers, engineers, and manufacturers across the product life cycle is the speed, cost, and quality of each process,” explains Hart.

His research seeks to overcome these barriers, and to enable the next generation of 3-D printers that **can be used** in the factories of the future. For this to be accomplished, synergy among machine design, materials processing, and computation **is required**. To work toward achieving this synergy, Hart’s research group examined the processes involved in the most well-known style of 3-D printing: extrusion. In extrusion, plastic **is melted and squeezed** through a nozzle in a printhead.

“We analyzed the process in terms of its fundamental limits — how the polymer **could be heated** and become molten, how much force **is required** to push the material through the nozzle, and the speed at which the printhead moves around,” adds Hart. With these new insights, Hart and his team designed a new printer that operated at speeds 10 times faster than existing printers. A gear that would have taken one to two hours to print could now be ready in five to 10 minutes. This drastic increase in speed is the result of a novel printhead design that Hart hopes will one day be commercialized for both desktop and industrial printers.

While this new technology could improve our ability to print plastics quickly, printing metals requires a different approach. For metals, precise quality control is especially important for industrial use of 3-D printing. Metal 3-D printing has been used to create objects ranging from airplane fuel nozzles to hip implants, yet it is only just beginning to become mainstream. Items made using metal 3-D printing are particularly susceptible to cracks and flaws due to the large thermal gradients inherent in the process.

To solve this problem, Hart is embedding quality control within the printers themselves. “We are building instrumentation and algorithms that monitor the printing process and detect if there are any mistakes — as small as a few micrometers — as the objects **are printed**,” Hart explains. This monitoring **is complemented** by advanced simulations, including models that can predict how the powder used as the feedstock for printing **is distributed** and can also identify how to modify the printing process to account for variations.

Hart’s group has been pioneering the use of new materials in 3-D printing. He has developed methods for printing with cellulose, the world’s most abundant polymer, as well as carbon nanotubes, nanomaterials that **could be used** in flexible electronics and low-cost radio frequency tags. When it comes to 3-D printing on a nanoscale, Hart’s colleague Nicholas Xuanlai Fang, professor of mechanical engineering, has been pushing the limits of how small these materials can be.

Printing nanomaterials using light

As advances in 3-D printing technologies made manufacturing processes for larger products cheaper and more efficient, Fang began to research how these technologies **might be used** on a much smaller scale. He turned to a 3-D printing process known as stereolithography. In stereolithography, light **is sent** through a lens and causes molecules to harden into three-dimensional polymers — a process known as photopolymerization.

The size of objects that **could be printed** using stereolithography were limited by the wavelength of the light that **is sent** through the optic lens — which **are called** diffraction limit — which is roughly 400 nanometers. Fang and his team were the first researchers to break this limit. “We essentially took the precision of optical technology and applied it to 3-D printing,” says Fang. The process, known as projection micro-stereolithography, transforms a beam of light into a series of wavy patterns. The wavy patterns **are transferred** through silver to produce fine lines as small as 40 nm, which is 10 times smaller than the diffraction limit and 100 times smaller than the width of a strand of hair.

“When you first start your engine, it’s the most problematic for volatile organic components and toxic gases. If we were to heat up this catalytic convertor quickly, we could treat those gases more effectively,” he explains. Fang has also created a new class of 3-D printed metamaterials using projection micro-stereolithography. These materials **are composed** of complex structures and geometries. Unlike most solid materials, the metamaterials don’t expand with heat and don’t shrink with cold.

Partnering with Industry

For 3-D printing to make a lasting impact on how products **are both designed and manufactured**, researchers need to work closely with industry. To help bridge this gap, the MIT Center for Additive and Digital Advanced Production Technologies (APT) was launched in late 2018. “The idea was to intersect additive manufacturing research, industrial development, and education across disciplines all under the umbrella of MIT,” explains Hart, who founded and serves as director of APT. “We hope that APT will help accelerate the adoption of 3-D printing, and allow us to better focus our research toward true breakthroughs beyond what **can be imagined** today.”

Efforts like APT, coupled with the groundbreaking work that **is done** in the sphere of additive manufacturing at MIT, could reshape the relationship between research, design and manufacturing for new products across industries. Designers could quickly <u>prototype</u> and <u>iterate</u> the design of products. Safer, more accurate metal hinges **could be printed** for use in airplanes or cars. Metamaterials **could be printed** to form electronic chips that <u>don't overheat</u>. Entire organs **could be grown** from donor cells on 3-D printed scaffolds. While these technologies may not spark the next Renaissance as the printing press did, they <u>offer</u> solutions to some of the biggest problems society <u>faces</u> in the 21st century.

Adapted from: http://news.mit.edu/2019/new-era-3d-printing-0516

Instructions: Individually, read the text about 3-D printing and complete the chart with the information requested.

A. Main idea of the text:

____
____
____.

B. What is said in the text about…?

1. Emanuel Sachs______________________________. 2. Binder jet printing: __________________________. 3. 1980s and '90s:______________________________. 4. Additive manufacturing: ______________________. 5. CAD: ____________________________________. **6.** Extrusion: _______________________________. 7. Examples of metal 3-D printing: ____.	8. Metal 3-D printing and algorithms: ____. 9. Cellulose: ________________________________. 10. Photopolymerization: ______________________. 11. Characteristics of metamaterials: ____.

C. Answer the following questions:

1. How has 3-D printing changed the process of prototyping of products?
____
____.

2. What is the issue that Prof. Hart found in regard to 3-D printing and its access to engineers and manufactures? Explain.
____
____.

3. Is metal 3-D printing flawless? Explain.
____
____.

4. What other fields of 3-D printing have Prof. Hart and his team explored?
____
____.

5. How does stereolithography work and what type of 3-D printing does it intend to create?
____
____.

6. Were Prof. Fang and his team able to deal with the diffraction limit? If so, explain.
____
____.

7. What can be achieved through the coupling of APT and advances in additive manufacturing?
____
____.

Handout 6

Part 1. Instructions: Look at all the materials used before. Copy the underlined words or phrases in column A and the words or phrases in **bold** in column B.

A	B

Part 2. Instructions: Analyze all the examples in column A. What similarity do they have? What differences do they have and why? Do the same for column B and comment your answers with a partner.

Part 3. Instructions: Analyze the example below with your classmates and teacher. Then discuss the questions below.

Smaller micro gas turbine engines **are built** by other engineers.

Object agent

Other engineers **build** smaller micro gas turbine engines.

Subject Object

1. In the first example, what is the focus of the sentence? ______________________________
2. In the second example, what is the focus of the sentence? ___________________________
3. When do you use passive voice? ____
4. When do you use active voice? ____

Part 4. Instructions: Analyze the examples below with your classmates and teacher and answer the questions below.

Underline the verb in each sentence. What is the difference? Why?

A. Nokia's platform provides a way to timestamp sensor data.
B. The turbines provide a less efficient system.

Underline the verb in each sentence. What is the difference? Why?

C. Powder used as the feedstock for printing is distributed
D. Diesel and gasoline are distributed in a simple way

What is the negative form of the previous sentences?

ANSWER KEY

Part 1. Instructions: Look at all the materials used before. Copy the <u>underlined</u> words or phrases in column A and the words or phrases in **bold** in column B.

A	B
Remembers allows are means monetize	Is sponsored are dominated is recognized
Take run perform happens	Is designed are seen are designed
Powers cool have does says	Are carried are considered are
Provides virtualize takes doesn't think	manufactured
Wear out start gets save requires	Are used can be exported can be used
Makes starts work gather add	Are exposed are implemented is required
Has wants timestamp collect	Are damaged are parked is melted
Is comes drops input adds	Are transported are donned is squeezed
Calls explains create focuses seeks	Are found are explored could be
Enable moves hopes comes causes	heated
Produce don't expand don't shrink need	Are built could be slotted are printed
Explains serves allow prototype	Is complemented is distributed could be used
iterate	Might be used is sent are called
Offer faces don't overheat	Could be printed are transferred are composed
	Can be imagined is done could be
	grown

Part 2. Instructions: Analyze all the examples in column A. What similarity do they have? (They are all in simple present, in active voice) What differences do they have and why? (Some have "s" because of third person singular) For column B: What similarity do they have? (They are all in simple present, in passive voice). What differences do they have and why? Some have "are" and others "is" because of singular and plural.

Part 3. Instructions: Analyze the example below with your classmates and teacher. Then discuss the questions below.

Smaller micro gas turbine engines **are built** by other engineers.

Object agent

Other engineers **build** smaller micro gas turbine engines.

Subject Object

1. In the first example, what is the focus of the sentence? Smaller micro gas turbine engines.
2. In the second example, what is the focus of the sentence? Other engineers
3. When do you use passive voice? To focus on the object that receives the action
4. When do you use active voice? To focus on the subject that makes the action.

Part 4. Instructions: Analyze the examples below with your classmates and teacher and answer the questions below.

Underline the verb in each sentence. What is the difference? Why? (the "s" because of third person singular)

A. Nokia's platform provides a way to timestamp sensor data.
B. The turbines provide a less efficient system.

Underline the verb in each sentence. What is the difference? Why? Is / are because of singular /plural subjects.

C. Powder used as the feedstock for printing is distributed.
D. Diesel and gasoline are distributed in a simple way.

What is the negative form of the previous sentences?

A. Nokia's platform doesn’t provide a way to timestamp sensor data.
B. The turbines don’t provide a less efficient system
C. Powder used as the feedstock for printing isn’t distributed.
D. Diesel and gasoline aren’t distributed in a simple way.

Handout 7

Instructions: In pairs, unscramble the sentences given. They contain simple present in active and passive voice. (To cut material)

Issues	with	noise	and	sound	are	often	overlooked.		
The	EPA	regulates	emissions	of	ozone	Precursors.			
Marine	engine	emissions	are	a	large	contributor	to	NOx	levels.
No	scrubbing	liquid	is	dumped	overboard.				
SOx	scrubbing	captures	sulfur	from	engine	exhaust			
The	process	is	not	needed	for	smaller	harbor	marine	engines
The	Bradley	systems	use	an	oxidizing	catalyst			

Sources:

https://www.asme.org/topics-resources/content/new-technology-for-noise-control

https://www.asme.org/topics-resources/content/new-nox-scrubbing-technology-for-diesel-marine

Handout 8

Instructions: Color the circle that indicates the correct pronunciation for the –ed endings of the verbs below.

VERB	/t/	/d/	/id/
Sponsored	O	O	O
Used	O	O	O
Exposed	O	O	O
Carried	O	O	O
Complemented	O	O	O
Printed	O	O	O
Considered	O	O	O
Exported	O	O	O
Recognized	O	O	O
Parked	O	O	O

VERB	/t/	/d/	/id/
Required	O	O	O
Melted	O	O	O
Squeezed	O	O	O
Called	O	O	O
Composed	O	O	O
Imagined	O	O	O
Designed	O	O	O
Transferred	O	O	O
Distributed	O	O	O
Heated	O	O	O

ANSWER KEY

Instructions: Color the circle that indicates the correct pronunciation for the –ed endings of the verbs below.

VERB	/t/	/d/	/id/
Sponsored		●	
Used		●	
Exposed		●	
Carried		●	
Complemented			●
Printed			●
Considered		●	
Exported			●
Recognized		●	
Parked	●		

VERB	/t/	/d/	/id/
Required		●	
Melted			●
Squeezed		●	
Called		●	
Composed		●	
Imagined		●	
Designed		●	
Transferred		●	
Distributed			●
Heated			●

Date: September 3rd, 2019.
Lesson plan # 4.
Teacher in charge: Garyan Rojas.
Assistant: Laura Coto.

Unit 1: Expanding Your Knowledge

1. **Unit Goal:** By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies.
2. **General Objective:** Correctly recognize the purpose of formal work email samples by summarizing and restating the reason of the emails.

Specific objectives: By the end of the lesson, students will be able to:

1. Identify the simple present in active and passive voice in written texts about new technologies as well as nouns and verbs that belong to a semantic group.
2. Identify the correct order of words in sentences in active and passive voice in the simple present tense.
3. Identify the correct pronunciation of past participle verbs.
4. Relate to the relevance that strategic email reading has for mechanical engineers.
5. Classify characteristics that belong to summarizing and paraphrasing as reading comprehension strategies.
6. Identify the meaning of words related to engineering processes, machine parts, and tools.
7. Demonstrate understanding of the content in short emails by matching them with their summarized and paraphrased versions.
8. Distinguish the most relevant information in short emails in order to complete summary and paraphrasing cards.
9. Develop complete, clear summary and paraphrasing cards based on the content of a medium-length email.
10. Identify and create properly-constructed sentences in the active and passive voice in the simple past tense.

Obj.	Procedures	Language	Strategies	Macro Skills	Time alloted
Sections to be completed from session # 3.					
1	**Check homework:** In pairs, sts compare their answers in handout 6 (from previous class) to review the use of simple present in active and passive voice. Sts also compare the vocabulary chart they created as part of the HW. Answers are checked as a whole class with the T.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** What phrases did you classify in the chart? What was your answer to # ___? Was this part clear to you? I'm not sure, let's double check with the teacher.	Identifying examples and patterns	R S	10
2	**Warm-up:** In pairs, sts have 5 minutes to unscramble sentences given in an envelope. They will contain sentences in simple present in active and passive voice. The team that finishes first gets a prize. Answers are checked as a whole class. Handout # 7 (from last class).	**Interaction language:** *It seems to me that this sentence goes like this because...* *I remember the order is first the subject and then the verb.* *What do you think about this order?* *Do you agree with the organization of this sentence?*	Identifying examples and patterns	R S	5

3	**Practice and follow up from last class.** T draws Sts' attention to the sentences they practiced in the warm-up and elicits the pronunciation of the regular past participle verbs. Sts mark the correct pronunciation for the participles using handout # 8. Sts compare and then share answers as a whole class.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *-What did you choose for the verb______?* *-When the final sound is voiced/voiceless, the –ed sounds like_______.* *-The exceptions were…*	Identifying examples and patterns	R W S	10
		Session # 4			
4	**Pre-task 1:** **Discussion:** Sts stand up and take a paper slip. If the paper slip contains an action (from glossary 1 or 2), S goes to the inner circle. If the paper slip contains a machine part (from glossary 1 or 2), S goes to outer circle. Once in the circle, sts discuss some questions in handout # 1 with the person in front of them. When the teacher rings a bell, outer circle rotates to the right and sts continue discussing the next questions with a different partner. The procedure is repeated several times until questions are over.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. Interaction language: *Let's start with the first question.* *The question says _______.* *Can you repeat that?* *I totally agree with you because…* *I agree up to a point, but…* *I am not sure about that because…*	Turn-taking	S L	10
	Pre-task 2:	**Task language:**			

5	-Sts get in groups of three (GT: sts' height). They will get a set of paper slips (handout # 2) which they have to group in order to put together the descriptors for the strategies of summarizing and paraphrasing. They will have 5 minutes. -When ready, answers are projected on the board for sts to compare them. -Answers are checked as a whole class and T makes sts aware that the first letters of the sentences form the name of the two strategies (summarizing and paraphrasing) and that at the same time these letters serve as acronyms including the tips for each strategy.	Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *What do you think?* *Do you agree/disagree?* *The way I see it, this matches the characteristics for ________ (summarizing/paraphrasing) because…* *When summarizing/paraphrasing something, I consider it's important to….*	Associating concepts	R S L	10
6	**Pre-task 3:** T makes reference to what sts discussed at the beginning about reading emails in order to explain that some vocabulary will be addressed before reading some emails. Vocabulary activity: Info gap. Sts get in pairs with the person next to them and sit face to face. They take turns reading the definitions given for the other to guess what the word is. Handout # 3.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *Who starts?* *I start/ You start.* *Can you read the definition again?* *I think the word is______.* *That's correct.*	Associating concepts	R L S W	10

		That's not correct.			
7	**Pre-task 4:** In the same groups of three made before, sts get a set of three e-mails as well as their corresponding paraphrased and summarized versions (all shuffled). Sts have to match each e-mail with the corresponding cards. Handout # 4.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *If you see this card, the ideas are very summarized, so it means that...* *Here I see the same idea in other words, so I think it is the summary/paraphrased card.* *I agree with you because it says that…* *I don't really agree because...*	Placing new words into a context Summarizing Paraphrasing	R S	10
8	**Pre-task 5:** Class is divided into two big groups (A-B). Group A is divided into pairs labeled A1-A2-A3 and group B into pairs labeled B1-B2-B3. Each pair gets an email and two blank cards for them to summarize and paraphrase the e-mail given. They will be given a set of prompting phrases that they can use as they develop their ideas. Then, subgroups exchange e-mails to compare the cards with the subgroup labeled with the same letter (E.g.: A1 with B1). Finally, all members from group A check the rest of group B's cards and vice versa. (Handout # 5.)	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language** *In order to summarize/paraphrase, remember that we have to…* *I think we can put it like…* *Yes, that sounds good!* *How about changing the idea here?* *We are done!* *We have to include….* *******	Placing new words into a context Summarizing Paraphrasing	R S W L	15

		We did it similarly because they wrote… *Maybe we can change this idea because…* *I think the summary/paraphrasing card is complete / incomplete/correct / incorrect because...*			
9	**Task**: *Create summary, paraphrasing and quote cards for formal work emails that are asking, explaining or requesting information.* Individually, all students get an email (same for all) and have to create the cards in order to paraphrase and summarize the information in the email. Handout # 6. **Planning:** Sts receive a checklist (handout # 7) to verify if the cards they completed meet all the requirements and that they have not forgotten to include anything. The checklist takes into consideration the tips they worked with during pre-task # 2. **Reporting:** Sts stand up and make two lines facing each other. They take turns comparing their cards. They rotate one step to the right to compare with at least two more people. They then report similarities and differences in the cards created.	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *How did you summarize the email?* *How did you paraphrase the email?* *I wrote….* *We did it similarly. My card says…* *I did it differently because I put...*	Placing new words into a context Summarizing Paraphrasing	R W S L	25

10	**Post-task** **Language focus:** A. Sts use handout # 8 to analyze utterances in simple past in active and passive voice. They need to decide if the lines are correct or incorrect and make the necessary adjustments to fix the wrong parts. (All examples are taken from the emails used during pre-tasks.) B. Then, T has sts identify the tense and the voice in the examples (active and passive). Then grammar is discussed. C. Sts find and circle the plural words in the previous examples. Attention is addressed to the pronunciation of -s endings in plural form. **Analysis:** Some analysis questions and examples are projected for sts to deductively contrast past and present tense in active and passive voice. Then, Sts go back to the summary and paraphrasing cards they created during the pre-tasks or task and analyze their use of past simple in active and passive voice. They make corrections if necessary. Sts try to pronounce the plurals they circled in handout # 8. Are they pronounced the same? Why? Rules for -s endings in plurals are explained. **Practice:** Sts complete a handout in which they have to transform affirmative and negative statements from	**Task language:** Simple present in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** *The plural of ______ (word) is*	Identifying examples and patterns Transferring	R S L W	15 15

	present to past in active and passive voice. Handout # 9. **Pronunciation:** In pairs, sts go back to the noun section in glossary # 3. They will practice pronouncing the plural form.	________ *because the final sound is voiced/voiceless* *It should be pronounced as ______ because it finishes with the spelling______.*			

Handout 1

Instructions: Use the following questions to talk with your partners about your opinion. Ask a different question to each classmate.

1. Why are emails important for mechanical engineers in the workplace?
2. For what purpose(s) do mechanical engineers need to read emails at work?
3. What are three important parts or sections in an email?
4. What is the meaning of summarize?
5. What is the meaning of paraphrase?
6. Is summarizing related to email reading in the context of mechanical engineers? If so, why?
7. Is paraphrasing related to email reading in the context of mechanical engineers? If so, why?
8. How can these strategies help you when reading emails at work?

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8. How can these strategies help you when reading emails at work?

Handout 2

Instructions: Group the paper slips in order to put together the descriptors for the strategies of summarizing and paraphrasing.

Put the ideas in your own words
Avoid making a copy of the text
Rearrange ideas that are similar
Ask yourself if all the important information was included

Shrink the ideas in the text
Use your own words
Main ideas and important details should be included

Handout 3

Instructions: Use the pictures and words in box A to guess the definition that your partner is telling you. Use the definitions in box B to read them to your partner for him/her to <u>guess the word in parenthesis.</u>

Box A

hub

quotation

supplier

Box B

1. The level to which something is limited, or the area within which something operates. (range)

2. An amount of money needed or used to do or buy something. (expense)

3. Glue (adhesive)

4. a piece of paper or other material that gives information about the object it is attached to (label)

5. metal fastener (screw)

6. a thin, solid, metal piece with a sharp point at one end (needle)

Instructions: Use the pictures and words in box A to guess the definition that your partner is telling you. Use the definitions in box B to read them to your partner for him/her to guess the word in parenthesis.

Box A

range

expense

adhesive

Box B

1. a long, usually plastic or rubber pipe used to move water or other substances (hose)

2. close-fitting covering to protect something (sheath)

3.a piece of paper which proves that money or goods have been received (receipt)

4. the central or main part of something where there is most activity (hub)

5. the price that a person says they will charge (quotation)

6. a person, company, or country that provides goods of a particular kind (supplier)

Handout 4

Instructions: Read the emails below. Then, using the cards provided, match each email to one of the summary cards and one of the paraphrasing cards.

Email # 1

From:	Misumi USA
To:	Diego
Subject:	Inquiry

Greetings Diego,

My name is Andrew, I'm a sales engineer with Misumi USA. According to recent data from our website, you <u>downloaded</u> CAD data for our precision positioning products. Thank you for considering us in your search! It is an honor for us to be your number # 1 preference.

Misumi, through its subsidiaries, is a leading supplier of precision positioning products in Japan, China, and Korea. We have a growing presence in the U.S and Canada. We have a wide range of off-the-shelf manual and motorized stages, and the ability to customize most of those products upon request. We are interested in knowing if we can supply you or your company with any of the products from our wide catalog.

If you have any questions about our products or customization options, feel free to contact me directly.

Best Regards,
Andrew Barendregt
Sales Engineer

Email # 2

From:	Diego
To:	Brad
Subject:	Measurement system

Brad,

I <u>contacted</u> technical support from Keyence and it <u>turned out</u> that the Keyence controller software <u>allowed</u> exporting the measure values to an excel file. The controller <u>had</u> to be connected to a computer all the time. This solution <u>was</u> very similar to what I <u>offered</u> you, which <u>was</u> to have a computer with a custom software to subtract and export the data.

We <u>quoted</u> you the service of going over there to configure the Keyence software, but I think it is more cost effective for you to do it yourself. Also, <u>did you ask</u> Keyence if they can provide technical support? Our service <u>cost</u> you around $4000 USD last year because of the flight ticket from Costa Rica to Wisconsin and other travel expenses.

If you want I can send you the contact of the technician I <u>talked</u> to.

Regards.

Email # 3

From:	Diego
To:	Brandon
Subject:	Question and quotation

Hi Brandon,

I hope you are doing fine. Do you remember the conversation we had some time ago? During the last meeting we talked about the new project for your company, and it **was based** on the requirements we discussed. At the end, you didn't send me a quotation because I had to send you a drawing or photo of the process for size reference, and I never did it. The good news is that the project is back on track and it started at the beginning of this week so I am looking forward to requesting PO this week. I already asked for the size reference, but you can work on the other components in the meantime. If you need help with this just drop me a line.

PD: Jeison sent the PO for last week's quotation today in the morning. Please let me know if you received it.

Thanks.

Instructions: Read the emails. Then, using the cards below, match each email to one of the summary cards and one of the paraphrasing cards.

Email # 1

Paraphrasing card

The sales engineer notified the client about the download of software data for the precision positioning products that the company sells. He mentioned some details about what his company sells as a lead supplier around the world. He motivated the client to purchase other products that can be customized according to the needs required.

Summary card

In this email, a supplier company sent a notification e-mail on some data that was downloaded and offered other products that can be customized according to client specifications.

Email # 2

Paraphrasing card

In this e-mail, one engineer e-mailed another one about what happened after contacting technical support from a company. The issue was that the controller software just needed to be connected to a computer to export data to an excel file. This engineer also recommended the other to configure the software himself because traveling to the USA to do the configuration was not a good idea.

Summary card

In this e-mail, the engineer said that the controller software just needed to be connected to a computer to export data to an excel file, and that going to USA to configure the software was very expensive.

Email # 3

Paraphrasing card

Some time ago two engineers had a conversation about some requirements. One said that a quotation was not completed because of a drawing of a process that was not sent. However, he said that the project is up again and that the purchase order was already requested. He also told his colleague that he could start working on the other components.

Summary card

In the email, one engineer told another one about a quotation for a project that was not sent to him. The good news is that the project is back on track and the process already started again.

Handout 5

Instructions: Write one summary card and one paraphrasing card for one of the emails below depending on the email you were assigned.

Email A

From:	Inquiry
To:	Team
Subject:	FAT results discussion - Meeting notes 05Oct

Hi team,

These are the notes of our call this morning.

Attendees: Diego O., Julie J., Soua Y., Jose V.

Discussion:

FAT **was run** yesterday at our company. After the first 20 units, a decrease on the amount of adhesive **was observed** and <u>left</u> a gap on the “front” of the hub, where the dispensing process starts. See picture 1 attached.
This decrease on the adhesive <u>continued</u> for the next 15-20 units, until it <u>was</u> easy to separate the hub form the sheath (see pictures 2 and 3)
The hoses and the valve **were cleaned** and white particles **were found**, most likely due to adhesive residue after weeks of not being used. Then the system **was cleaned** and the flow of adhesive **was as expected** after this.
The positioning of the needles <u>was</u> an issue after the system **was cleaned.** Similar to the first attempt on the FAT, the adhesive <u>didn't flow</u> on the gap between the sheath and the hub, therefore it <u>was</u> quite simple to separate both parts.

Next steps:
Work on the accurate positioning of the needles. This includes marks on the adjusting screws to be able to revert to the original position. R/ Diego. Due: 10/8
Send more hubs to CR for further testing / FAT. R/Julie, Soua. Due: 10/5
Run another trial for the 150 units. R/ Diego, Rosa, Jose. Due: 10/10

Email B

From:	Diego
To:	Mr. Harrington
Subject:	Machine Action Plan

Dear Mr. Harrington,

Here are the answers to your questions regarding the machine. I hope we can discuss them in more detail during our meeting on Wednesday.

What was the problem with the machine?

The amount of adhesive decreased after a number of unit assembly. It got such a low quantity of adhesive that eventually the machine started to assemble units with gaps in the adhesive union (“holes”). The number of assembled units had a visually noticeable decrease and depended on the parameter set on the machine (pressure on the tube, valve opening, times on the recipe).

What do we think happened? We considered two possibilities.

Somehow the physical properties of the adhesive changed during the 300 pieces run, due to temperature changes or adhesive curated by being out of the tube on the hoses, needles or valve (the hoses were opaque and black and the needles had black covers to avoid being exposed to UV).
The pressure wasn't high enough to supply a constant as the adhesive tube went empty.

What did we expect from the tests?

Best scenario possible, a 300 pieces run at 15 psi **was completed** without noticing any decrease in the amount of adhesive, therefore it didn't make any pressure adjustment. That meant that we ran with wrong pressure values all along.

If the pressure change **was needed,** we plan to get enough data for analysis that determines the most appropriate way to make that correction.

After the testing, we will provide a proposal to fix the problem.

Best regards

Email C

From:	Mark
To:	Carolina
Subject:	Test Box User Needs

Carolina,

I hope you are fine. Last week I sent you an e-mail asking about the printer. You mentioned the need for a thermal printer that **was integrated** to the equipment. What type of information **was printed**? Was it an adhesive label or regular receipt? Which was the required size of the print?

A very important detail is that Billy didn't comment about this feature, maybe he didn't have any information. That information was critical for us. Could you give me call to explain this to you more in detail? I worked on other parts of the proposal but that information **was needed** to give you a formal quotation.

Lastly, I sent you a meeting invitation for the 28th. I tried to send it to Bryan but the email **wasn't delivered** for some reason.

Regards, Mark

Group: ____

Email: ____

Summarize it!

____

____

____

____

Paraphrase it!

____

____

____

____

Useful language:

- *In order to summarize/paraphrase, remember that we have to…*
-I think we can put it like…
-Yes, that sounds good!
-How about changing the idea here?
-We are done!
-We have to include….

ANSWER KEY

Email A Summary

The emails contain the minute of a meeting in which FAT was discussed in order to identify flaws of the process and take action to fix them. People responsible for tasks and due dates were assigned to the pending tasks.

Email B Summary

An engineer is following up on the technical issues of a machine. The problems and causes are identified, as well as expectations from a test to be carried out in order to fix the issues.

Email C Summary

An engineer is requesting detailed information about the specifications that a client requires for certain equipment in order to include all the details in the project proposal.

***Note: Paraphrasing of each email will vary depending on each student since they are encouraged to use their own words.

Handout 6

Part I. ***Instructions***: Read the following email carefully.

From:	Diego
To:	Bill
Subject:	Updated Test Box proposal

Hello Bill,

Let me give you a quick overview of this project. I sent to Carolina a proposal for a custom equipment to replace the Test Box that **was used** to test the dual pressure sensor 1620-4-W-A2703. The proposal described equipment with the same basic features, but had hardware and software from 2019 (Test box used operational amplifiers to compare the value of the reading, very interesting design but obsolete and very inconvenient)

Even though I sent a formal proposal, I added a note to point out that we needed to double check the components that **were chosen** to process the output signal with the design values expected according to the manufacturer or designer of the sensor. It is very likely that the module that **was chosen** will work, but it is too risky to continue with the PO before checking that out. Therefore, we need to know some details.

What is the resolution (mV/V) of each sensor?
*Is there a chart from the manufacturer with expected value from the function mV vs mmHg? (for example, if you supply air at X mmHg the sensor will output a signal of Y mV). It is possible to generate that data using the current equipment but only if it is completely impossible to get the information from the manufacturer.

I attached the documentation Billy sent. There was some important information but not all data we needed.

There was another note on the proposal. We didn't find the 6-pin female connector of the dual sensor. Bryan said that he located it but didn't tell me if BSCI will provide them or there is a supplier that sells them.

Please let me know

Part II. *Instructions:* Complete the following summary card and paraphrase card based on the information contained in the previous email.

Summarize it!

____

____

____

____

Paraphrase it!

____

____

____

____

ANSWER KEY

Summary: The engineer is requesting missing information that is necessary to update a project proposal, and he is also suggesting the client to make some changes to the original proposal based on the needs of the equipment.

***Note: Summary may vary depending on each student

Paraphrasing: Answers may vary depending on each student since they are encouraged to use their own words.

Handout 7

Instructions: Circle the (√) if the descriptor is present in the cards you completed. Circle the (*X*) if the descriptor is not present and make the necessary adjustments in the cards.

Paraphrasing. -I made sure that…		
ideas were put in my own words	√	*X*
I did not make a copy of the text	√	*X*
rearranged similar ideas	√	*X*
all important information was included	√	*X*
Summarizing -I made sure that…		
ideas in the text were shortened	√	*X*
I used my own words	√	*X*
main ideas and important details were included	√	*X*

Instructions: Circle the (√) if the descriptor is present in the cards you completed. Circle the (*X*) if the descriptor is not present and make the necessary adjustments in the cards.

Paraphrasing. -I made sure that…		
ideas were put in my own words	√	*X*
I did not make a copy of the text	√	*X*
rearranged similar ideas	√	*X*
all important information was included	√	*X*
Summarizing -I made sure that…		
ideas in the text were shortened	√	*X*
I used my own words	√	*X*
main ideas and important details were included	√	*X*

Handout 8

Part I. *Instructions:* Analyze the lines below in terms of meaning and form. If the sentence or question is correct write C in the blank next to it, or I if the sentence is incorrect.

1. The number of assembled units was had a visually noticeable decrease. ________
2. It was depended on the parameters set on the machine. _________
3. The process was completed without noticing any decrease in the amounts of adhesive. _________
4. During the last meeting we was talked about the new projects for your company. _________
5. The project was based on the requirements we discussed. _________
6. The hoses and the valves cleaned and white particles found. _________
7. The pressure wasn't high enough to supply a constant as the adhesive tubes went empty. ________
8. We needed to double check the components that was chosen for the process. _________
9. There were another note on the proposal. _________
10. What type of information was printed? _________

Part II. ***Instructions:*** Make the necessary corrections for the sentences that you marked as incorrect in the previous exercise.

Part III. ***Instructions:*** Circle plural words in the previous exercise. How do you pronounce those plurals? What is the rule for the pronunciation of the plurals?

/s/	/z/	/iz/
Final sound in the word is VOICELESS	Final sound in the word is VOICED	Check for final spellings like: -s -ch -z -sh -ge -x
Example:	*Example:*	*Example:*
Requirements	Designs	Processes

ANSWER KEY

1. The number of assembled units was had a visually noticeable decrease. Incorrect

Correction: The number of assembled units ~~was~~ had a visually noticeable decrease.

2. It was depended on the parameters set on the machine. Incorrect

Correction: It ~~was~~ depended on the parameters set on the machine.

3. The process was completed without noticing any decrease in the amounts of adhesive.

   Correct

4. During the last meeting we was talked about the new projects for your company.

   Incorrect

Correction: During the last meeting we ~~was~~ talked about the new projects for your company.

5. The project was based on the requirements we discussed. Correct
6. The hoses and the valves cleaned and white particles found. Incorrect

Correction: The hoses and the valves **were** cleaned and white particles **were** found.

7. The pressure wasn't high enough to supply a constant as the adhesive tubes went empty.

   Correct

8. We needed to double check the components that was chosen for the process. Incorrect

Correction: We needed to double check the components that **were** chosen for the process.

9. There were another note on the proposal. Incorrect

Correction: There was another note on the proposal.

10. What type of information was printed? Correct

Handout 9

Instructions: Transform the sentences below from present to past. If possible, also change them from active to passive voice and vice versa.

1. We need to prevent any leaking through ball bearing.

____

2. A pressure transducer sensor is needed for the machine.

____.

3. We want to determine how many adjustments are needed to complete the 300 unit run with a constant amount of adhesive.

____.

4. I don't want to quote you items with a 6-8 week lead time.

____.

5. The user needs for the products are identified by George.

____.

6. The operator passes the air through the system and then closes the valve.

____.

7. I have a few questions about the measurement system at our manufacturing site.

____.

8. We don't need to send that quote yet.

____.

Date: September 9th, 2019.
Lesson plan # 5.
Teacher in charge: Laura Coto
Assistant: Garyan Rojas

Unit 1: Expanding Your Knowledge

1. **Unit Goal:** By the end of the unit, students will be able to successfully demonstrate comprehension of mechanical engineering texts containing technical vocabulary by implementing appropriate reading strategies.

1. **General Objective:** To review vocabulary and reading strategies studied in unit 1 in order to prepare students for the reading and vocabulary test.

Specific objectives: By the end of the lesson, students will be able to:

1. Identify the simple past in active and passive voice in written texts about new technologies.
2. Recognize the function of reading strategies and key words studied during unit 1.
3. Define key words related to machine parts, tools, and new technologies as well as reading strategies studied during unit 1.

Obj.	Procedures	Language	Strategies	Macro Skills	Time allotted
1	**Check homework:** Sts and T check answers to the handouts assigned for homework last class.	**Task language:** Simple past in active and passive voice, nouns and verbs related to new technologies, engineering processes, and machine parts and tools. **Interaction language:** What is the answer for # __? I have a doubt in ____.	Turn taking	L	10
2	**Schema activation:** sts recall and write all the reading strategies that they have studied during unit 1. Then they recall which categories of words /vocabulary we have studied. They stand up and write their ideas in a newsprint paper.	**Task language:** Words related to machine parts and tools. Words related to new technologies. Nouns, verbs, adjectives. Names of reading strategies studied in unit 1	Categorizing	R W S	10

	On the board, sts are shown the list of strategies and word categories we have studied and they have to check if they are the same or if they are missing any.	**Interaction language:** Do you remember…? We studied…			
3	**Pre-task 1:** **Stations:** Sts work in stations. # 1: (Vocabulary) They take turns and grab one of the cards from the pile. The cards contain words that have been studied in class during unit 1, and an indication to either define it or put it into a sentence. If sts provide a definition, partners have to guess the word. If sts provide a sentence, partners have to identify the "key" word and check that the sentence is correct. Handout # 1 # 2: (Vocabulary) Memory game: Sts play a memory game with the cards containing definitions of words studied during unit 1. Handout # 2. # 3: (Reading) Sts take turns to turn around the cards, which contain the name of one reading strategy studied in unit 1. They need to describe the strategy, and partners have to guess which strategy it is. Handout # 3	**Task language:** Words related to machine parts and tools. Words related to new technologies. Nouns, verbs, adjectives. Names of reading strategies studied in unit 1 **Interaction language:** It's my/your turn This word means… This definition goes with this word. Is it….? This reading strategy consists of…	Turn taking	S L R	15 (5 in each station)
Evaluation: Sts complete the unit evaluation, and the student-teachers' evaluation.					20
Test: Sts take the reading and vocabulary test.					90

Abbreviations to be used: T = teacher A = assistant Ss = students L = listening S = speaking R = reading W = writing Others: GT: grouping technique

Handout 1

Coupling (Definition)	Diagnosis (Sentence)
Fin (Definition)	Flaw (Sentence)
Bitcoins (Definition)	Nozzle (Sentence)
Shaft (Definition)	Modularity (Sentence)
Assemble (Definition)	Signal (Sentence)
Enable (Definition)	Quote (Sentence)
Wear out (Definition)	Adhesive (Sentence)

Answer key

Definitions:

Coupling: joining two things together

Fin: a plate or other object which is attached to a surface in order to improve the flow of heat.

Bitcoins: a digital currency produced by a public network

Shaft: a metal bar in an engine that causes a part to move when another part moves

Assemble: to come together in a single place or bring parts together in a single group

Enable: to make someone able to do something, or to make something possible:

Wear out: to make someone extremely tired

Definitions and sample sentences provided by students may vary

Handout 2

Instructions: Turn around two cards a time to try to match a word and a definition.

HUB	SHEATH
BURNISH	SMOOTH
HINGE	GROUNDBREAKING
SUPPLY	

the central or main part of something where there is most activity

a close-fitting covering to protect something

to make or become shiny or smooth by friction; polish

having a surface or substance that is perfectly regular and has no holes or lumps

a folding device, usually made of metal, that is attached to a door, gate, or lid on one side, allowing it to open and close

original and important; showing a new way of doing or thinking about things

to provide something that is needed or wanted

Handout 3

Reading strategy: SYNONYMS	Reading strategy: SCANNING
Reading strategy: ANTONYMS	Reading strategy: SUMMARIZING
Reading strategy: APPOSITIVES	Reading strategy: PARAPHRASING
Reading strategy: DIRECT DEFINITION	Reading strategy: CONTEXT CLUES
Reading strategy: SKIMMING	Reading strategy: EXAMPLE

Answer key

Synonyms: Through this context clue, the reader discovers the meaning of an unknown word because it repeats an idea but expressed in similar words that are nearby. These are words with the same meaning.

Antonyms: These are used to express opposite meanings. An opposite meaning context clue contrasts the meaning of an unfamiliar word with the meaning of a familiar one.

Appositives: They are nouns or noun phrases that define or restate another noun. They follow the word they define and are set off by commas.

Direct definition: A new concept is formally defined or the reader encounters a sufficient explanation within the sentence. You can pay attention to words like: "that is", and parenthesis ().

Example: Sometimes a new word is surrounded by something that illustrates it nearby to explain its meaning. The phrase "such as" is used to introduce this context clue.

Skimming: It's reading a text quickly in order to find specific information, e.g. figures, numbers or names. Learning to use your hands while doing this is very helpful in locating specific information.

Scanning: It's reading a text quickly to get a general idea of meaning. It is important to understand that there is no need to read every word when applying this strategy.

Summarizing: Shorting the ideas including main ideas and details.

Paraphrasing: Putting the ideas in your own words avoiding copying the text.

Appendix EE. Unit 2 Lesson Plans and Materials

Date: September 16th, 2019.
Lesson plan # 6.
Teacher in charge: Garyan Rojas.
Assistant: Laura Coto.

Unit: 2 Engineering production

Goal: By the end of the unit, students will be able to write emails, descriptions of procedures and processes as well as lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.

General objective:

By the end of the lesson, students will be able to:

1. Properly write inquiry emails to experts in mechanical engineering by following the format of sample emails provided.

Specific objectives: By the end of the lesson, students will be able to:

1. Identify the correct tense and voice for verbs depending on the context.
2. Match summarized and paraphrased versions of emails to recall main ideas appropriately.
3. Identify parts of an email as well as composing and format features that can be used or adjusted while writing emails.
4. Identify appropriate greetings, leave takings, and phrases for formal emails.
5. Recognize appropriate responses to formal emails.
6. Write complete, formal email responses based on the prompts and with appropriate formality.
7. Write complete email responses based on the cards created in unit 1 to respond to the inquiry or request with the appropriate formality.
8. Differentiate and apply the functions of modal verbs to express advice, obligation, request, and possibility when writing formal emails.

Obj.	Procedures	Language	Strategies	Macro Skills	Time allotted
1	**Warm-up:** In pairs, sts compete to complete the two sentences they were given in slips of paper by choosing from the verbs posted around the class. Once they choose the verb, they need to decide if the sentences need a verb in active or passive voice, or if the verbs need to go in present or past. Sts can negotiate and exchange verbs with other groups if necessary. Answers are checked as a whole class. (Handout # 1)	**Task language** Passive voice and active voice in the simple present and the past tense. Machine parts, processes, and tools. **Useful language** _____ *goes in this sentence* *The verb has to be in present/ past /active voice / passive voice* *Can /Could we use this one?* *Should we use present?*	Placing words into a context	S R	10
2	**Schema activation** Teacher uses questions in the presentation to recall emails used two sessions ago. Topics, purposes, writers, and subjects are elicited. Then in pairs, sts are given one summary and paraphrasing sheet (the ones used two sessions ago) and have to match it with the corresponding email. (Use previous versions of emails)	**Task language** Passive voice and active voice in the simple present and the past tense. Machine parts, processes, and tools. **Useful language** *The emails were about…* *This email matches with this summary card.*	Using memory for retrieval	S L	10

		Might this email go with this card?			
3	**Pre-task 1:** In pairs, sts first talk about email domains they frequently use and say why they prefer one particular domain over the other. They will be shown the most popular ones: Gmail, Outlook, and Yahoo! Then, they complete a labeling exercise that contains the names of different parts of an email as well as names of features they can add or adjust while composing an email. Answers and pronunciation are checked as a whole class. (Handout 2)	**Task language** Vocabulary related to email writing and text features when composing an email. **Useful language:** *I think this refers to______.* *You are right.* *I don't think that's the right name for that.*	Associating concepts	S R W	20
4	**Pre-task # 2:** Sts work in handout # 3 in order to identify appropriate greetings, leave takings, and phrases for formal emails. They also discuss about the formal email do's and don'ts provided and come up with some recommendations of their own.	**Task language** Greetings, leave takings, email expressions. Modal verbs and modal phrases. **Useful language** *This is (in) appropriate because…* *One example of this is…* *I (dis) agree with this recommendation because…* *Another recommendation is that you...* *Must we use / write…?* *Should the greeting be…?* *May we write…?*	Analyzing expressions	S R W	20

5	**Pre-task # 3** In the same pairs, sts match a set of emails with their response. The emails correspond to the same they used two sessions ago with minor adaptations. (Handout 4). They comment about the email responses and analyze them in terms of formality, appropriateness, and completeness.	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. **Useful language:** *Do these papers match?* *Yes, they should go together.* *I think this is not the response we need.* *I think this response is (in)appropriate/ (in)complete / (in)formal because….*	Skimming Scanning	R S	10
6	**Pre-task # 4:** Sts stand up and exchange email addresses with at least 6 classmates. They take notes of the emails in their notebooks. Sts work in pairs to draft a response to the email provided. Then using cell phones or computers, sts send their response to another pair for them to respond as in a thread. They are encouraged to follow the recommendations and to use the sample greetings, leave takings, and phrases from pre-task 2. (handout #5) <u>GT for email drafting and writing</u> A1-A1/ B1-B1/C1-C1/ A2-A2/ B2-B2 / C2-C2 <u>GT for exchanging and thread writing</u>	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. **Useful language** @ = at . = dot / = slash _ = underscore - = hyphen	Using resources for sending messages		25

	A1- C2 / B1 - A2 / B2 - C1	Capital letters = ABC Small case letters= abc We should reply by saying that… Can / could we say that…?			
7	**Task**: *Write emails based on the cards created in unit 1 to respond to the inquiry or request with the appropriate formality.* Students are assigned one email and have to write a response to it individually. They first draft it on paper and then do it online by using their cellphones in order to send it to their English course email. Teachers will respond to it and provide feedback over the week. (Handout # 6). **Planning:** Sts get in groups of three. They will exchange responses by sending theirs to their two classmates and will go over the list of do's and don'ts in pretask # 2 to evaluate the responses their partner wrote. **Reporting:** In the same groups, sts report similarities and differences they found in the responses. Finally, T has sts share ideas as a whole class.	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. **Useful language:** *In this part of the response, you may/might/could/can/should/must...* *In the response, I think you should adjust/change_____ because...*	Using resources for sending messages	R W S L	35

8	**Post-task** <u>Language focus:</u> Sts find examples of modals verbs in statements and questions in the emails from the pre-tasks and useful language provided. They also check the emails they created for more examples. <u>Analysis:</u> Modal verbs are analyzed in terms of their function and form. Attention is also addressed to rising intonation in yes/no questions. <u>Practice:</u> **A.** Individually, sts work on a sentence and question formation exercise by using the prompts given and choosing the correct modal verb according to the function provided in parenthesis. Sts stand up and compare answers. Then, exercise is checked as a whole class. Handout # 7. **B**. Pronunciation practice. Sts practice rising intonation with the questions in handout # 8 and in the other questions from the emails and useful language boxes. All of them will be show in a list on the board.	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. **Useful language:** What did you write in #_____? I have the same. Mine is not correct. I should change it. You *may/might/could/can/should/must_ ____(verb) because...*	Using linguistic clues	L R W S	20

Handout 1

You ________________ CAD data for our precision positioning products.
We _________ you the service of going over there to configure the software.
It ______ easy to separate the hub from the sheath.
The adhesive __________ on the gap between the sheath and the hub.
The amount of adhesive _______________ after a number of unit assembly.
The physical properties of the adhesive ________ during the 300 pieces run.
The needles ______ black covers to avoid being exposed to UV.

A decrease on the amount of adhesive ______________.
The system ____________ after the positioning of the needles.
The pressure change _________ for analysis and decide the appropriate way to make the correction.
A 300 pieces run at 15 psi ___________ without noticing any decrease in the amount of adhesive.
The need of a thermal printer _____________ to the equipment.
I tried to send the information but the email ____________ for some reason.
The project _____________ on your requirements.

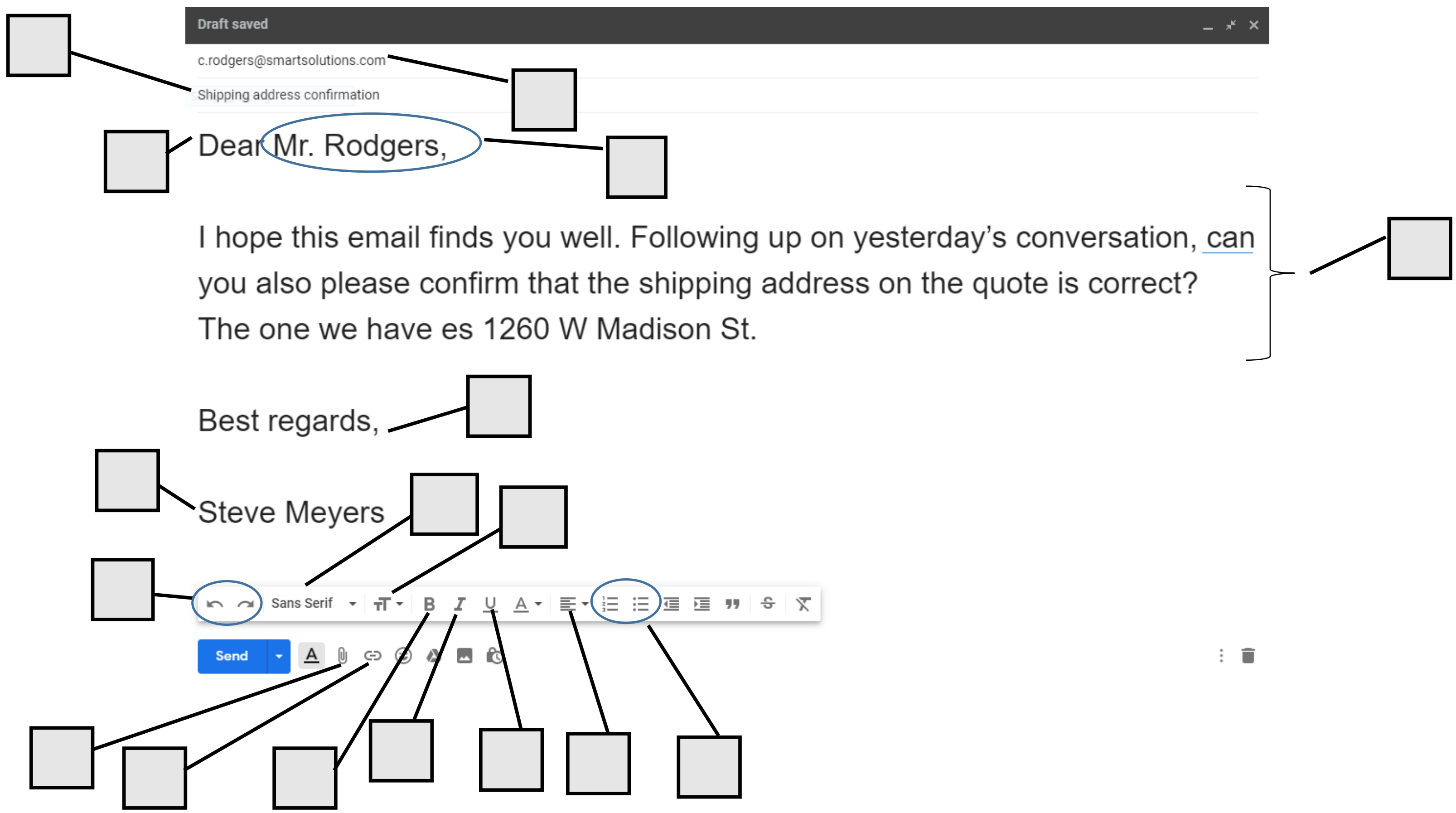
DOWNLOAD
QUOTE
BE
FLOW (negative)
DECREASE
CHANGE
HAVE
OBSERVE
CLEAN
NEED
COMPLETE
INTEGRATE
DELIVER (negative)
BASE

WARM UP ANSWER KEY

1. You downloaded CAD data for our precision positioning products.
2. We quoted you the service of going over there to configure the software.
3. It was easy to separate the hub from the sheath.
4. The adhesive didn't flow on the gap between the sheath and the hub.
5. The amount of adhesive decreased after a number of unit assembly.
6. The physical properties of the adhesive changed during the 300 pieces run.
7. The needles had black covers to avoid being exposed to UV.
8. A decrease on the amount of adhesive was observed.
9. The system was cleaned after the positioning of the needles.
10. The pressure change was needed for analysis and decide the appropriate way to make the correction.
11. A 300 pieces run at 15 psi was completed without noticing any decrease in the amount of adhesive.
12. The need of a thermal printer was integrated to the equipment.
13. I tried to send the information but the email wasn't delivered for some reason.
14. The project was based on your requirements.

Handout 2

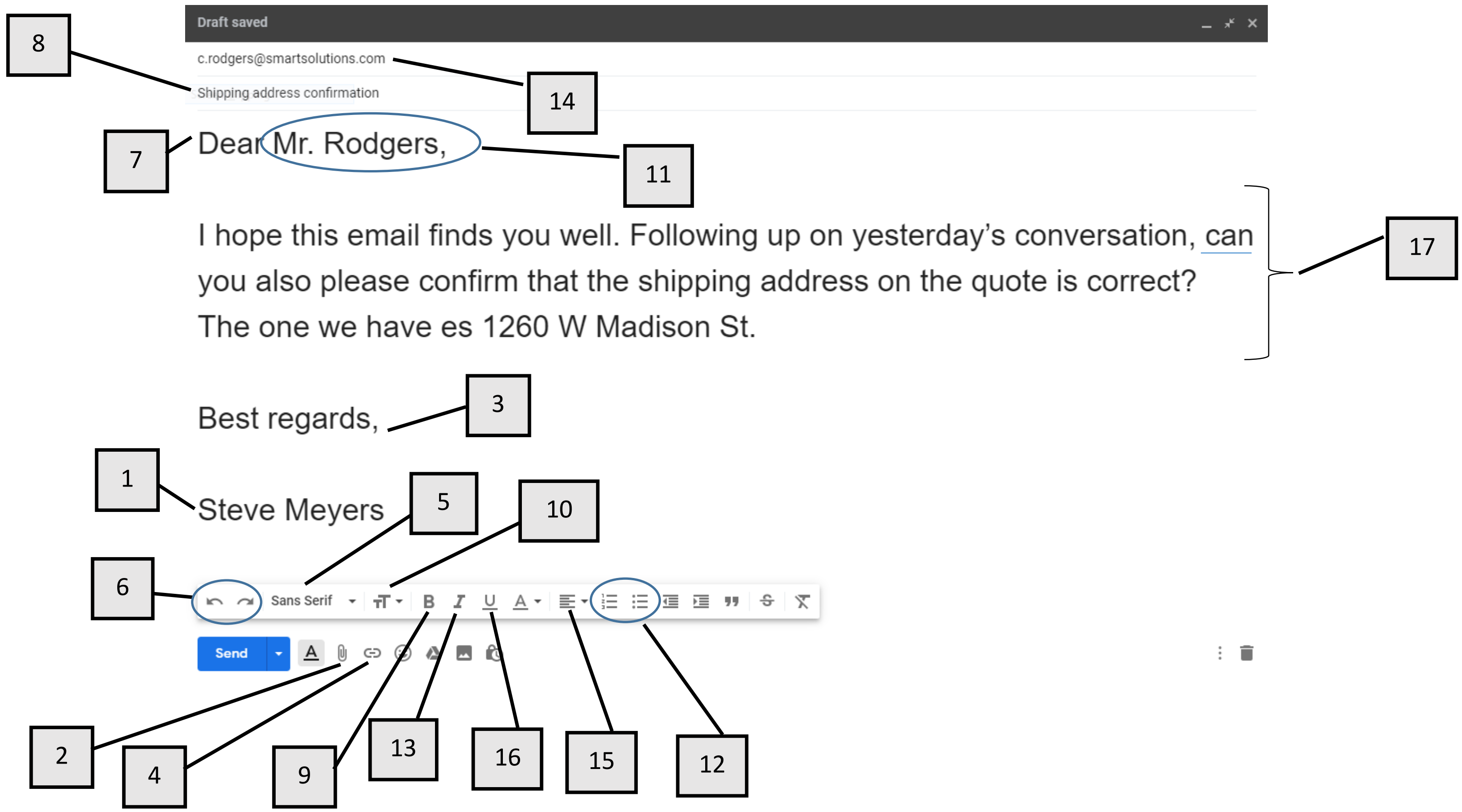
Instructions. Analyze the email box and label its components by writing the numbers from the box in the corresponding square.



1. Sender	2. Attach	3. Leave-taking	4. Hyperlink	5. Font	6. Do & Undo
7. Greeting	8. Subject	9. Bold	10. Font size	11. Recipient	12. Bulleted list & numbered list
13. Italics	14. Email address	15. Align	16. Underline	17. Body	

ANSWER KEY

Instructions. Analyze the email box and label its components by writing the numbers from the box in the corresponding square.



1. Sender	2. Attach	3. Leave-taking	4. Hyperlink	5. Font	6. Do & Undo
7. Greeting	8. Subject	9. Bold	10. Font size	11. Recipient	12. Bulleted list & numbered list
13. Italics	14. Email address	15. Align	16. Underline	17. Body	

Handout 3

Part 1. *Instructions:* Write a check (✓) next to the greetings, leave takings, and email phrases that you consider are appropriate to be included in a formal email.

Greetings

☐Hello	☐ Hope this email finds you well	☐Happy "Not Monday"
☐Hi	☐ I hope you're having a wonderful day	☐I hope you had your coffee already
☐What's up?	☐ Just what you want: another email!	☐Dear Mr. / Ms. [last name]
☐What's new?	☐ Hope you're surviving another workweek	☐Marco
☐Hey	☐ It's me again	☐To whom it may concern
☐Good morning	☐ Hello from the other side	☐Gentlemen
☐How are you?	☐ Dear [first name]	

Leave takings

☐Cheers	☐Thanks for the quick response	☐Talk to you tomorrow
☐Bye	☐Cheers	**☐Xoxo:**
☐See you	☐Enjoy the weekend	**☐See you tomorrow**
☐Regards	☐Happy Wednesday	**☐Later**
☐Thank you for your help	☐Excited to hear your thoughts	**☐Take care**
☐Thank you for the update		
☐Thanks for getting in touch		

Body

☐As we discussed on our call...

☐What's the matter this time?

☐Can you provide me with an update on...

☐I think you forget to reply to my emails

☐I'm checking in on...

☐I'm getting back to you about...

☐To follow up on our meeting...

☐This email is to request this information one more time

☐Send the quote tomorrow at 2:00 pm or I won't buy the components.

Part 2. *Instructions:* Read and discuss with your partner the following recommendations for formal email writing. Give examples when possible and say whether you agree or disagree with any of the recommendations.

✓	X
You should proofread your message for grammar, spelling, punctuation, and word choice before sending it.	You must not use humor or sarcasm.
You can include attachments and double check they are attached.	You should not overuse exclamation points.
You have to include a greeting, body, closing, and leave taking.	You should avoid using negative words.
You should use standard fonts and colors.	You cannot forget to include a clear, concise subject line.
You must consider your email tone.	You may disable "Sent from my phone" caveat.
You should use Bcc appropriately.	You should not reply to one email in several, separate threads.
You have to be discrete about confidential information.	You should not introduce a new topic in the middle of an email thread.
You could insert emojis, but only if it is strictly necessary in order to clarify meaning.	You might not want to reply to everyone who received the email unless it is relevant to them.
You must reply to the email within 48 hours.	You must not use capital letters.
You may create a professional email address.	You should avoid using informal abbreviations and contractions.

Part 3. *Instructions:* Write any additional suggestions for formal email writing you may have. You can use the prompts in the box to help you write your ideas.

____

____

____

____

____

____

Prompts
You should (not) / must (not) / ought to/ had better (not)…
You can (not) / could (not)….
You may (not) / might (not) ….
You have to…

Handout 4

Instructions: Read the emails carefully and match them with the appropriate response.

From:	Misumi USA
To:	Diego
Subject:	Inquiry

Greetings Diego,

My name is Andrew, I'm a sales engineer with Misumi USA. According to recent data from our website, you downloaded CAD data for our precision positioning products. Thank you for considering us in your search! It is an honor for us to be your number # 1 preference.

Misumi, through its subsidiaries, is a leading supplier of precision positioning products in Japan, China, and Korea. We have a growing presence in the U.S and Canada. We have a wide range of off-the-shelf manual and motorized stages, and we can customize most of those products upon request. We are interested in knowing if we could supply you or your company with any of the products from our wide catalog.

If you have any questions about our products or customization options, you may contact me directly.

Best Regards,
Andrew Barendregt
Sales Engineer

Greetings,

Thank you very much for your email. There is an upcoming project for next month and I need a quote for a stepper motor and a nanopositioning controller. Once you send me this information, I will discuss the quotation with my supervisor and I will let you know how the pieces should be customized.

Sincerely,

xxxxxxxx

From:	Diego
To:	Brad
Subject:	Measurement system

Brad,

I contacted technical support from Keyence and it turned out that the Keyence controller software <u>could</u> export the measure values to an excel file. The controller <u>had to be</u> connected to a computer all the time. This solution was very similar to what I offered you, which was to have a computer with a custom software to subtract and export the data.

We quoted you the service of going over there to configure the Keyence software, but I think it is more cost effective for you to do it yourself. Also, did you ask Keyence if they <u>can</u> provide technical support? Our service cost you around $4000 USD last year because of the flight ticket from Costa Rica to Wisconsin and other travel expenses.

If you want I <u>can</u> send you the contact of the technician I talked to.

Regards.

Good evening,

I hope everything is doing well. I am glad to hear that you were able to figure out what the issue was once you reached the support team. We decided that we <u>can</u> work on the configuration ourselves in order to reduce costs. <u>Could</u> you send me the contact information of the technician? I will really appreciate it.

Thanks,

xxxxxxx

From:	Diego
To:	Brandon
Subject:	Question and quotation

Hi Brandon,

I hope you are doing fine. Do you remember the conversation we had some time ago? During the last meeting we talked about the new project for your company, and it was based on the requirements we discussed. At the end, you couldn't send me a quotation because I had to send you a drawing or photo of the process for size reference, and I never did it. The good news is that the project is back on track and it might start at the beginning of this week so I am looking forward to requesting PO this week. I already asked for the size reference, but you can work on the other components in the meantime. If you need help with this just drop me a line.

PD: Jeison sent the PO for last week's quotation today in the morning. Please let me know if you received it.

Thanks.

Greetings,

Thanks for notifying me about it; it is great news to hear that we can finally start working on it. The purchase order was already received so you must not worry about it. It should be processed before Friday, but I will inform you about any status change. In addition to this, I will get started with the other parts that are needed and were not included in the quotation. I will let you know if I need something else.

Best regards,

xxxxx

Handout 5

Instructions: In pairs, write a response to the email provided.

Email # 1

From:	Diego
To:	Team
Subject:	FAT results discussion - Meeting notes 05Oct

Hi team,

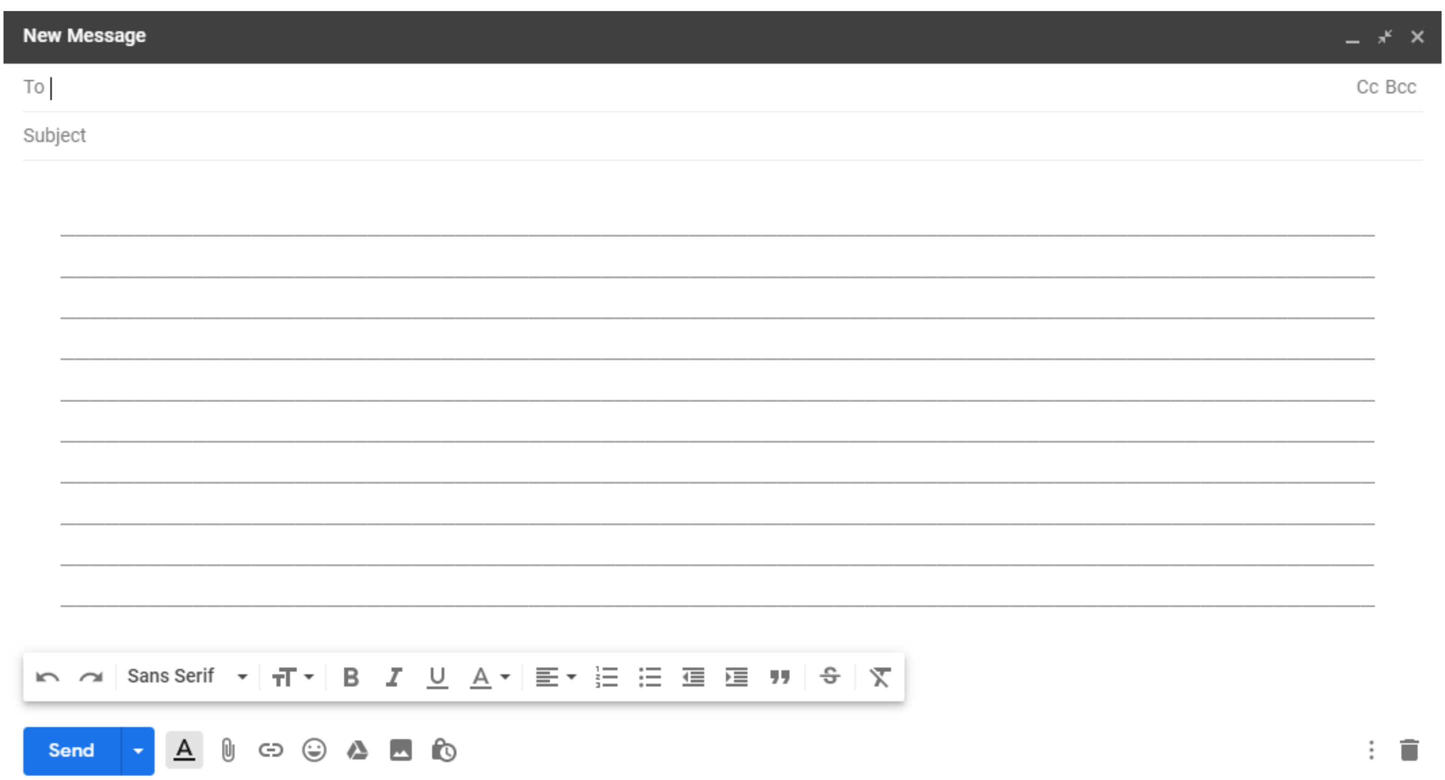
These are the notes of our call this morning.

Attendees: Diego O., Julie J., Soua Y., Jose V.

Discussion:

FAT was run yesterday at our company. After the first 20 units, a decrease on the amount of adhesive was observed and left a gap on the "front" of the hub, where the dispensing process starts. You can see picture 1 attached.
This decrease on the adhesive continued for the next 15-20 units, until it was easy to separate the hub form the sheath (see pictures 2 and 3)
The hoses and the valve were cleaned and white particles were found, most likely due to adhesive residue after weeks of not being used. Then the system was cleaned and the flow of adhesive was as it should be after this.
The positioning of the needles was an issue after the system was cleaned. Similar to the first attempt on the FAT, the adhesive didn't flow on the gap between the sheath and the hub, therefore it was quite simple to separate both parts.

Next steps:
Work on the accurate positioning of the needles. This might include marks on the adjusting screws to be able to revert to the original position. R/ Diego. Due: 10/8
Send more hubs to CR for further testing / FAT. R/Julie, Soua. Due: 10/5
Run another trial for the 150 units. R/ Diego, Rosa, Jose. Due: 10/10



Instructions: In pairs, write a response to the email provided.

Email # 2

From:	Diego
To:	Mr. Harrington
Subject:	Machine Action Plan

Dear Mr. Harrington,

Here are the answers to your questions regarding the machine. I hope we can discuss them in more detail during our meeting on Wednesday.

What could be the problem with the machine?

The amount of adhesive decreased after a number of unit assembly. It got such a low quantity of adhesive that eventually the machine started to assemble units with gaps in the adhesive union ("holes"). The number of assembled units had a visually noticeable decrease and depended on the parameter set on the machine (pressure on the tube, valve opening, times on the recipe).

What do we think happened? We considered two possibilities.

Somehow the physical properties of the adhesive changed during the 300 pieces run, due to temperature changes or adhesive curated by being out of the tube on the hoses, needles or valve (the hoses were opaque and black and the needles had black covers to avoid being exposed to UV).
The pressure wasn't high enough to supply a constant as the adhesive tube went empty.

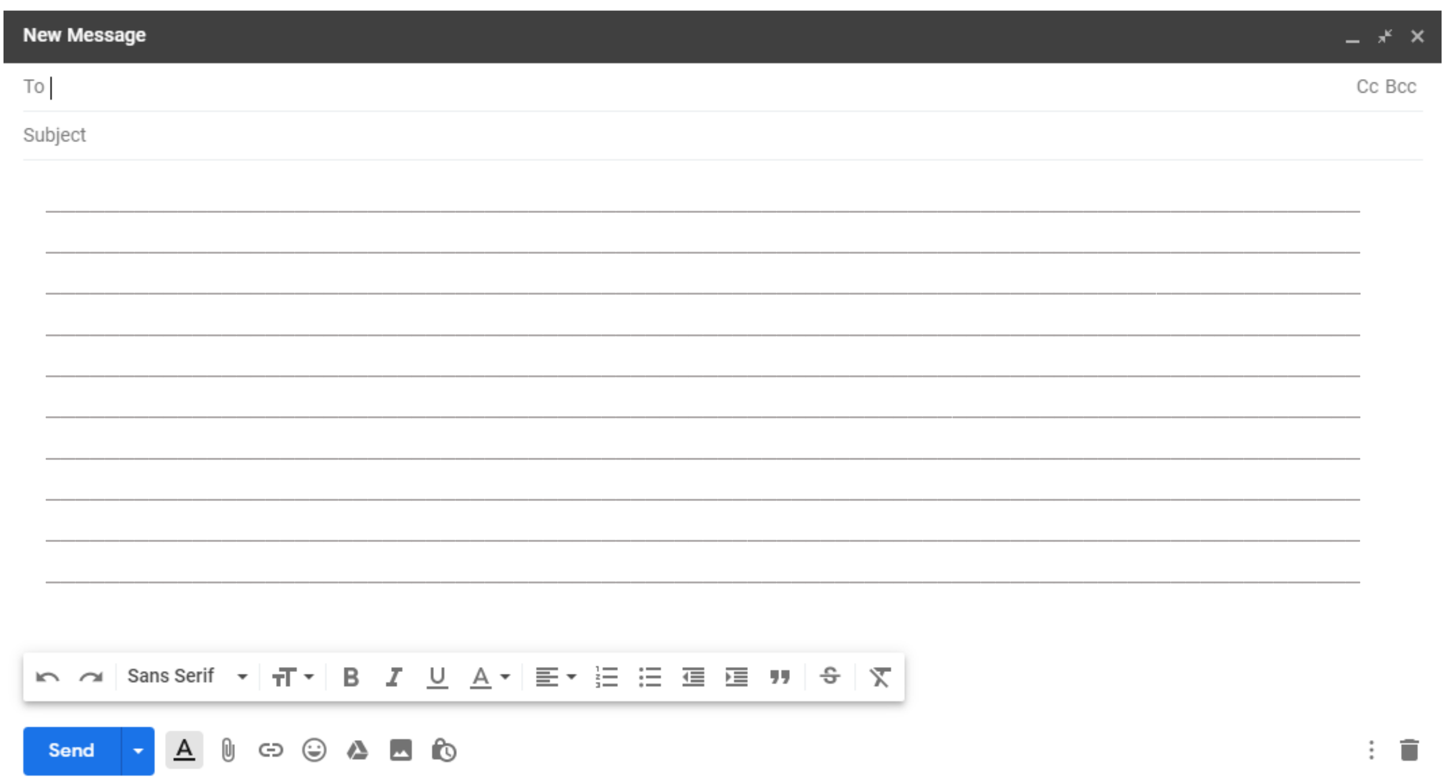
What might we expect from the tests?

Best scenario possible, a 300 pieces run at 15 psi is completed without noticing any decrease in the amount of adhesive, therefore it should not make any pressure adjustment. That might mean that we ran with wrong pressure values all along.

If the pressure change is needed, we must get enough data for analysis that determines the most appropriate way to make that correction.

After the testing, we have to provide a proposal to fix the problem.

Best regards



Instructions: In pairs, write a response to the email provided.

Email # 3

From:	Mark
To:	Carolina
Subject:	Test Box User Needs

Carolina,

I hope you are fine. Last week I sent you an e-mail asking about the printer. You mentioned the need for a thermal printer that could be integrated to the equipment. What type of information should be printed? Should it an adhesive label or regular receipt? Which is the required size of the print?

A very important detail is that Billy didn't comment about this feature, maybe he didn't have any information. That information was critical for us. Could you give me call to explain this to you more in detail? I worked on other parts of the proposal but that information was needed to give you a formal quotation.

Lastly, I can sent you a meeting invitation for the 28th. I tried to send it to Bryan but the email wasn't delivered for some reason.

Regards, Mark

Handout 6

Instructions: Individually, read the email below and write a formal response to it by using your cellphone. You can use the box below the email to draft your response before sending it.

From:	Diego
To:	Bill
Subject:	Updated Test Box proposal

Hello Bill,

Let me give you a quick overview of this project. I sent to Carolina a proposal for a custom equipment which must replace the Test Box that was used to test the dual pressure sensor 1620-4-W-A2703. The proposal described equipment with the same basic features, but had hardware and software from 2019 (Test box used operational amplifiers to compare the value of the reading, very interesting design but obsolete and very inconvenient)

Even though I sent a formal proposal, I added a note to point out that we have to double check the components that were chosen to process the output signal with the design values expected according to the manufacturer or designer of the sensor. The module that was chosen may work, but it is too risky to continue with the PO before checking that out. Therefore, we must know some details.

What is the resolution (mV/V) of each sensor?
*Is there a chart from the manufacturer with expected value from the function mV vs mmHg? (for example, if you supply air at X mmHg the sensor will output a signal of Y mV). We can generate that data using the current equipment but only if it is completely impossible to get the information from the manufacturer.

I attached the documentation Billy sent. There was some important information but not all data we should know.
There was another note on the proposal. We couldn't find the 6-pin female connector of the dual sensor. Bryan said that he could locate it but didn't tell me if BSCI will provide them or there is a supplier that sells them.

Please let me know

Handout 7

Instructions: Write sentences or questions using modals verbs according to the indication in parenthesis.

1. You / quote / these / components (request - question).

____.

2. They / use / the / valves / recommended (advice – statement)

____.

3. Another / test / be / necessary / for / the / machine (possibility – statement)

____.

4. The / technician / calibrate / the / motor / ASAP (obligation – statement)

____.

5. We / run / another / FAT / tomorrow (advice – question)

____.

6. Mr. Meyers / provide / us / with / this / information (request – question)

____.

7. We / assemble / 600 units / as / a / minimum (obligation – statement)

____.

ANSWER KEY

Instructions: Write sentences or questions using modals verbs according to the indication in parenthesis.

1. You / quote / these / components (request - question).

Can you quote these components?

2. They / use / the / valves / recommended (advice – statement)

They should use the valves recommended.

3. Another / test / be / necessary / for / the / machine (possibility – statement)

Another test might/could be necessary for the machine.

4. The / technician / calibrate / the / motor / ASAP (obligation – statement)

The technician must calibrate the motor ASAP.

5. We / run / another / FAT / tomorrow (advice – question)

Should we run another FAT tomorrow?

6. Mr. Meyers / provide / us / with / this / information? (request – question)

Can/could Mr. Meyers provide us with this information?

7. We / assemble / 600 units / as / a / minimum (obligation – statement)

We must assemble 600 units as a minimum.

Job Aid: Writing Emails

Keep in mind the following language samples when writing emails in order to make them formal and appropriate:

Appropriate Greetings and Openings	Appropriate Closings and Leave takings
Good morning/afternoon/evening. Dear Mr. / Ms. / Mrs. _______. (last name) Greetings To whom it may concern. I hope this email finds you well. I hope you are having a nice day. I hope you are doing well. It is a pleasure to be in touch with you again.	Thank you for your help Thank you for the update Thanks for getting in touch Looking forward to hearing from you Have a nice day Best regards Best Regards,

Purposes	Language
Explaining results	-After carrying out the test, it was found that… -A test was carried out ______ (time), and it was observed that… -The implications for_____ are basically that… -Based on the results, we need to go on with… -It was found that…, therefore the next step consists of… -Adjustments need to be made since the results are telling us that…
Describing projects' progress	-So far, we have completed stages_____ and _____, which means that… -During the last ______ (time), the stages of _____ and ____ were successfully completed/not completed as expected. For that reason, … -The project will be completed before the deadline. -I am afraid that due to events out of our control, this stage will be completed ____(time) after the deadline established.
Asking for quotations	-The company has been working on_____ as part of the new project. For that reason, I need you to quote me a/an _____ (machine part/component). -Can you quote me _______? -I am interested in knowing what the price for____ (machine part/component) is.
Negotiating	-Is there anything we can do to get the components delivered before _____ (date)? -What are the possibilities for us to get the_____ (machine part/components) by _____ (date)? -If there are no budget limitations, would it be possible to…
Scheduling meetings	In order to have a closer follow-up on our current projects, we will need to meet on ____ (date)… The next meeting will be held in____(place) at____ (time). The points that will be addressed during the meeting are…

Date: September 23rd, 2019.
Teacher in charge: Laura Coto
Assistant: Garyan Rojas
Lesson plan # 7

Unit # 2: Engineering Production

Unit Goal: By the end of the unit, students will be able to write emails, descriptions of procedures and processes, and lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.

General Objective: At the end of the lesson sts will be able to coherently write the description of mechanical procedures in the workplace by clearly listing steps required for the procedure to be completed.

Specific Objectives: At the end of the lesson, sts will be able to:

1. Differentiate and apply the functions of modal verbs to express advice, obligation, request, and possibility by analyzing formal emails.
2. Accurately match technical vocabulary with their illustration for schema activation by participating on an online trivia.
3. Properly identify information in manuals by matching sections with their illustration.
4. Correctly identify parts of a manual by matching manual sections and steps.
5. Coherently describe the use of manuals and process flow diagrams and their parts by writing the answers to questions.
6. Coherently write a short general description of a mechanical engineering process by looking at a manual process flow diagram.
7. Write a manual for a machine by completing all the necessary parts of the manual using imperatives correctly.
8. Accurately identify the correct use of imperatives by correcting mistakes in manuals and by using imperatives correctly in grammar exercises.

Obj.	Procedures	Language	Strategies	Macro Skills	Time Allotted
Part 1: Activities to be completed from Objective # 1 (Previous class)					
	(Task done previous class) **Planning:** Sts get in groups of three. They will go over the list of do's and don'ts in pretask # 2 to evaluate the responses their partners wrote. (answers have been previously sent to their emails) **Reporting:** In the same groups, sts report similarities and differences they found in the responses. Finally, T has sts share ideas as a whole class.	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. ***E.g.:*** *We should generate the data as soon as possible.* *We couldn't find the 6-pin female connector.* **Useful language:** *In this part of the response, you may/might/could/can/should/must ...* *In the response, I think you should adjust/change_____ because...*	Using resources for sending messages	R W S L	10 min
	Post-task Language focus: Sts find examples of modals verbs in statements and questions in the emails from the pre-tasks and useful language provided. They also check the emails they created for more examples. Analysis: Modal verbs are analyzed in terms of their function and form. Attention is also addressed to rising intonation in yes/no questions.	**Task language** Modal verbs for request, possibility, advice, and obligation and vocabulary related to machine components, requirements, and functions. ***E.g.:***	Using linguistic clues	L R W S	20

	<u>Practice:</u> **A.** Individually, Sts work on a sentence and question formation exercise by using the prompts given and choosing the correct modal verb according to the function provided in parenthesis. Sts stand up and compare answers. The exercise is then checked as a whole class. Handout # 7. **B**. Pronunciation practice. Sts practice rising intonation with the questions in handout # 8 and in the other questions from the emails and useful language boxes. All of them will be show in a list on the board.	*They should use the valves recommended.* *You must know all these details.* **Useful language:** What did you write in #_____? I have the same. Mine is not correct. I should change it. You *may/might/could/can/should/must _____(verb) because...*			
Part 2 Unit objective # 2					
1	**Warm up:** Ss play a kahoot game to guess the correct words related to processes and machine parts. Objective for the lesson is projected and sts are provided glossary # 4 containing the words in the previous game and some other words needed for the lesson.	**Key Language for task** Nouns and verbs related to processes and machine parts **Useful language** I think this is ___ Choose ____	Associating concepts	S R	10 min
2	**Pre-task # 1:** Sts are provided with a general information guide for the turret rewinder so that they use it as a reference for the rest of the lesson, since all the following handouts will relate to this machine. In small groups (2-3), Ss look at four different sections of a manual for the reel change cycle of a turret rewinder. They need to match the sections	**Key Language for task** Nouns and verbs related to processes and machine parts Imperatives. **E.g.:** *The serrated knife moves in cut position.* *Lock system in release position.* **Useful language**	Scanning Exchanging information	R S	10 mins

	with the corresponding image. *Materials:* Handout # 1 cut in cards, one set of cards per group.	I think section #___ corresponds to this image. This image represents section #..._			
3	**Pre-task # 2:** Individually**,** sts write the letter of the answer option that contains the correct manual section or indication for each manual step in the boxes. *Materials:* Handout # 2 one per student. They then compare answers with a partner and check.	**Key Language for task** Technical expressions and symbols for mechanical engineering processes and steps. **E.g.:** *Make sure no personnel is staying at the danger area of the line.* *Take notice that the air has to be of good quality.* **Useful language** The correct answer for the first / second/third box is…	Skimming	R W	10 mins
4	**Pre-task # 3:** Ss go to the different stations and answer the questions (Handout # 3) about characteristics of manuals and flow diagrams using one of the spaces provided in the sheet of paper. They fold their answer for partners not to see it and continue doing the same in the next stations. (Chinese fan technique). When all groups have been to all stations, papers are unfolded and answers are compared and checked as a whole class.	**Key Language for task** Technical expressions and symbols for mechanical engineering processes and steps. **E.g.:** *Organize the information into sections.* *Good flow diagrams should have clear symbols.* **Useful language** In my opinion…. The first/second/ third answer is… Let's write…	Analyzing and reasoning	R W S	15 mins
5	**Pre-task # 4:** Ss work on handout # 4. They individually study the process flow diagram for a few minutes. They then comment their understanding of it with a partner and then write a description of the process it represents.	**Key Language for task** Imperatives, technical expressions, and symbols for mechanical engineering processes and steps. **E.g.:** *Check the water supply*	Using graphic organizers (Process flow diagram)	R W	15 mins

		Release compressed air. **Useful language** This diagram is for ___ The process consists of _____ This diagram describes_____ First, second, third, next, then, after,		S	
6	**Task:** In small groups, Ss create a short manual or guide describing the procedures for the appropriate use of a machine or mechanical equipment of their choice, or based on the process flow diagram. **Planning:** They write the manual in the template (handout # 5) and verify they have included all necessary information. **Report:** Manuals are pasted around the class for other groups to do a supervising round and "evaluate" the manual using the evaluation forms (handout # 6). They report their ranking in small groups and discuss choices.	**Key Language for task** Sequencers, imperatives, ordinal numbers, machine parts, technical expressions, and symbols for mechanical engineering processes and steps. **E.g.:** *Check ON/OFF status trough using a LED display.* *Make sure that the power supply is off while wiring.* **Useful language (Manual writing)** -What is the first step? -This step is first, second, etc -The safety precautions are… -We need to write … -__is 1st, 2nd, etc. - First, then, next, after, before, **Useful language (Manual evaluation)** Let's give this manual __ stars in this section because… I think the manual is _____ because…	Using graphic organizers Using mechanical techniques	W S L R	40 mins for task 10 mins for planning **Reporting will be done next class***
This section is for observers' reference only since it will be carried out on the following session					
	Post-task:	**Key Language for task**	Skimming		

7	**Language Focus: A.** Ss go back to the material they used during pre-task and have to highlight verbs that give instructions and circle words that indicate order. **B.** Use of imperatives and sequencers is explained and discussed. Pronunciation for TH in ordinal numbers is addressed as well. **Analysis:** Ss check manuals created and analyze the use of imperatives in the manuals. **Practice:** Ss work on the correction of imperatives in their manuals and practice pronunciation of ordinal numbers in them as well.	Imperatives, sequencers, ordinal numbers. **E.g.:** *Second, remove the discharge needle from the rear of the main unit.* *After cleaning the discharge needle, mount it.*			

Handout 1

Section # 1: Normal Winding Process

- Turret system is switched off in the cutting position
- Winder 1 is switched on and is connected to the winding system and Winder 2 is switched off

or

- Winder 2 is switched on and is connected to the winding system and Winder 1 is switched off
- Contact roller is positioned at the reel
- Cutting system is in home position
- Torsion spring is in zero (0) position
- The serrated knife is secured by the knife guard

Section # 2: Indexing Process

Step	Explanation
1	Indexing system is switched on; maximum turret speed is achieved. The destination is the cut position according to the selected core diameter, 3” or 6”. Winder 1 is switched on and is connected to the winding system Winder 2 will be switched on (synchronous surface speed) or Winder 2 is switched on and is connected to the winding system Winder 1 will be switched on (synchronous surface speed) Contact roller stops in the last winding position
2	The indexing system is in cut position. After indexing the contact roller is moved forward until a distance of approx. 10 mm between running web and prepared core is reached. The serrated knife moves in cut position and the knife arm is prepared for the cross cut by loading the torsion spring motor-driven. The cut system **(11)** swivels in cut position. Ready winder is for cut!
3	The prepared join is detected by sensors.

Section # 3: Indexing process completed – Cutting

A

The knife is fired

- After approx. 45° swivel angle the serrated knife cuts the web.
- The cut triggering is so carried out that the brush pushes the beginning of the web on the prepared join.

B

Cutting system ready for the cut

- Lock system in lock position
- Cutting spring is loaded
- The join is synchronized with the cutting system
- Unlock the spring loaded knife system

C

Cutting system into basic position

- Lock system brought in release position
- Cutting spring is relaxed in home position
- Lock system in release position
- The shock-absorber has destroyed the rest energy.

Section # 4: Return to normal winding operation

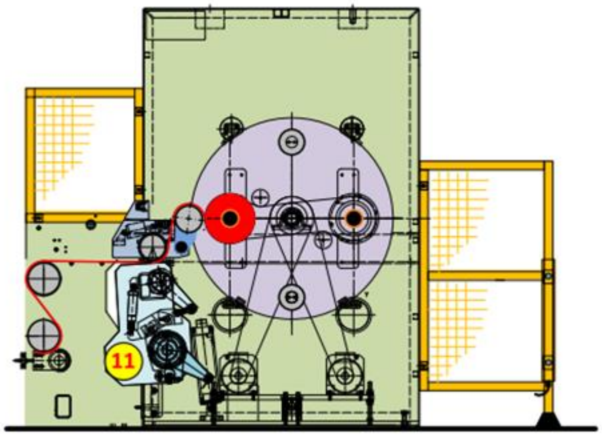
After Cutting and lay-on process

- Contact roller is positioned at the reel
- Cutting spring is in zero (0) position
- Serrated knife is secured by knife guard
- Reel transfer system **(11)** swings to home position
- The indexing system indexes the winding station from cutting into winding position and the finished reel in unloading position.
- The turret system is switched off

A complete reel change has been carried out.

The finished reel can now be unloaded.

The winding station in basic position then can be equipped with an empty core.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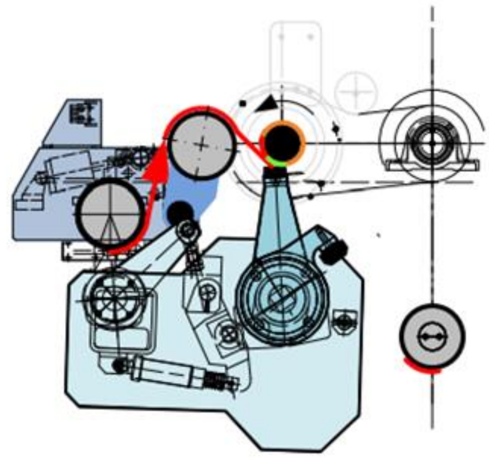

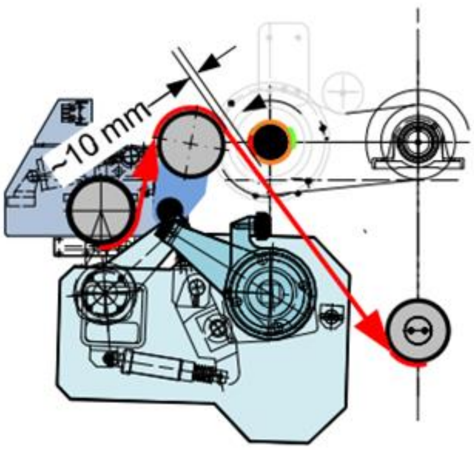
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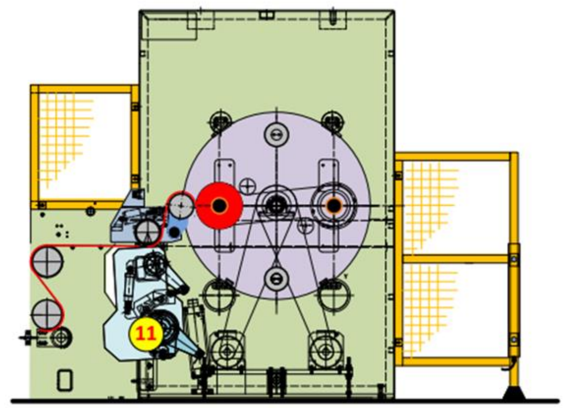
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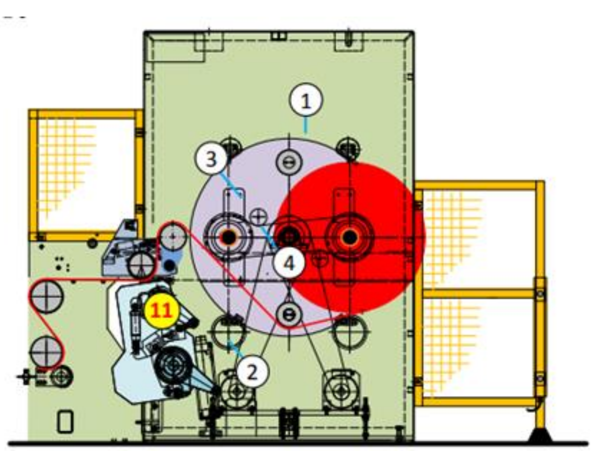
1
3
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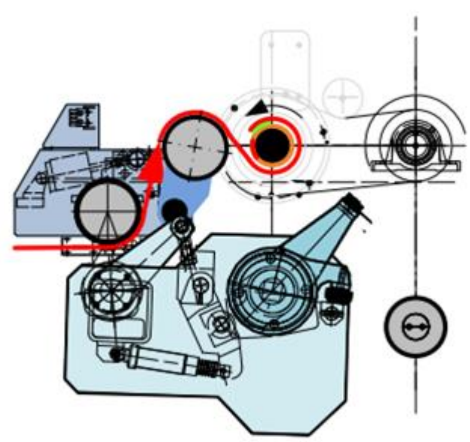
11
2



Handout 2

Instructions: Look at the manual on the left for the operation of the line's electrical supply. Match the steps with their corresponding name <u>or</u> symbol indication. (Two symbols are the same so you can use it twice).

Operation of the Line's Electrical Supply

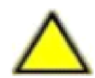
STEPS	NAME / INDICATION
Take notice that the air has to be of good quality. That means containing low rest density and no impurity.	
The incoming supply pressure has to always higher than 6 bars, the operating pressure of the line.	
Open the compressed air supply for the line and set the air pressure to 5 bars at the maintenance unit.	
Attention: Never just switch off the system WinCC, but always drive down as aimed.	
Actuate. Only after releasing the Emergency Stop Circle, which is placed in the Emergency Stop Devices at the production line, the winding machine can be switched on.	
Before switching on the line, make sure no personnel is staying at the danger area of the line.	
At the whole line (pre-machine) the Emergency Stop devices have to be unlocked and the Emergency Stop Chain has to be released.	

ANSWER OPTIONS

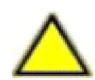
A. Maintenance Unit

B. Emergency Stop key

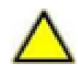
C. Emergency Stop Reset

D. 

E. 

F. 

ANSWER KEY

STEPS	NAME / INDICATION
Take notice that the air has to be of good quality. That means containing low rest density and no impurity. The incoming supply pressure has to always higher than 6 bars, the operating pressure of the line.	
Open the compressed air supply for the line and set the air pressure to 5 bars at the maintenance unit.	**A**
Attention: Never just switch off the system WinCC, but always drive down as aimed.	
Actuate. Only after releasing the Emergency Stop Circle, which is placed in the Emergency Stop Devices at the production line, the winding machine can be switched on.	**C**
Before switching on the line, make sure no personnel is staying at the danger area of the line.	
At the whole line (pre-machine) the Emergency Stop devices have to be unlocked and the Emergency Stop Chain has to be released.	**B**

Handout 3

Questions for stations

1. What are three different parts or sections of manuals in mechanical engineering?
2. When are manuals necessary and/or useful for a mechanical engineer?
3. What three strategies can you use to write a good mechanical engineering manual?
4. How can the process in manuals be represented in a visual, graphic way?
5. What is a process flow diagram? Write a short definition or description.
6. What are three characteristics of a good process flow diagram?
7. What symbols are commonly used for process flow diagrams in mechanical engineering? (Make drawings if necessary). Write the meaning of the symbols.

Handout 4

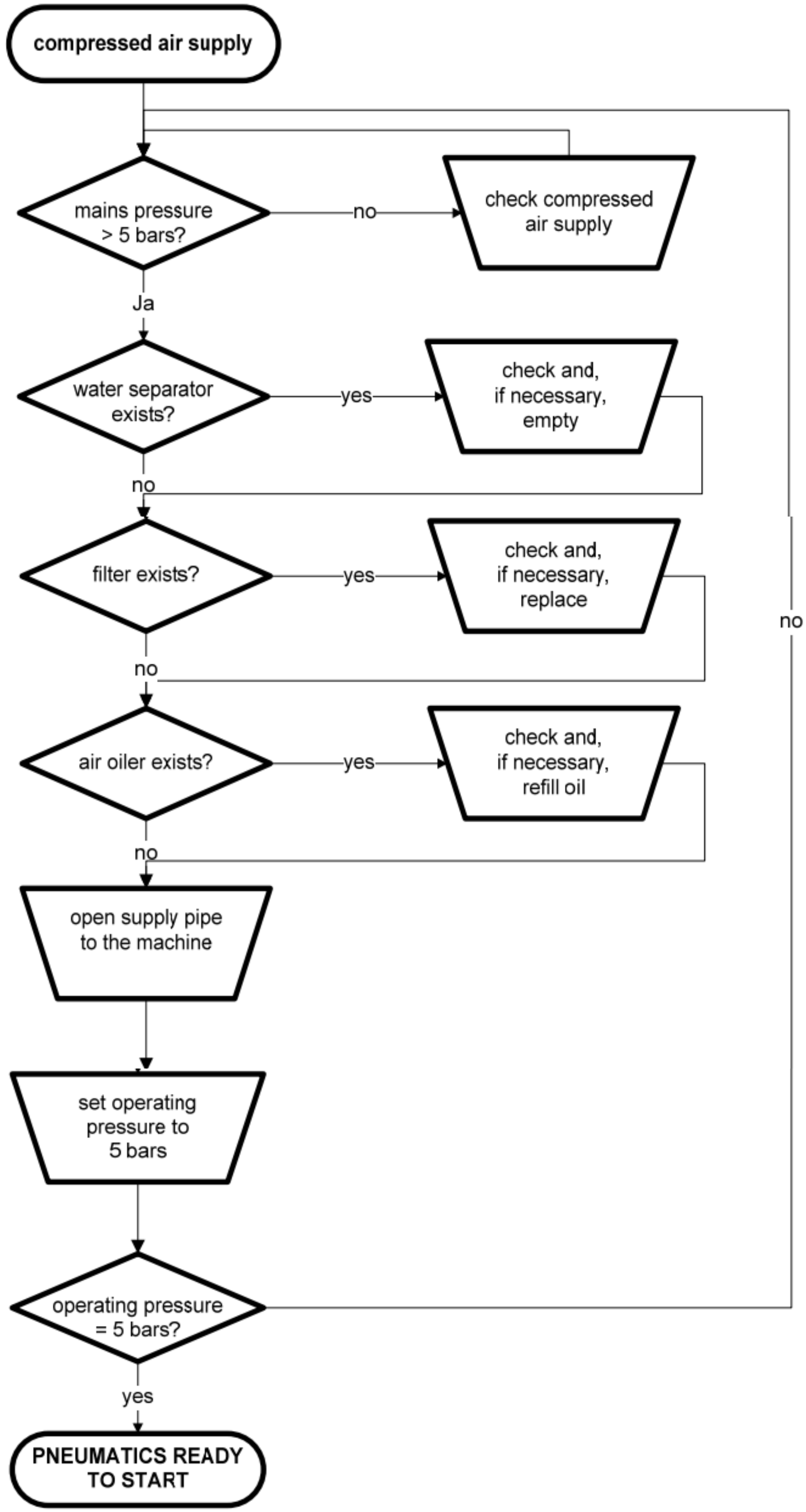
Instructions: Study the process flow diagram below. What process does it represent? Write a short description of the
process.

Useful language

-First, second, third, etc

- Next, then, before, after, etc

- Connect, release, compress, supply, check reclaim, replace, refill, accelerate, stop, open, set, reset, switch, etc,.



Date: September 30th, 2019.
Lesson plan # 8.
Teacher in charge: Garyan Rojas
Assistant: Laura Coto

Unit 2: Engineering Production

1. **Unit Goal:** By the end of the unit, students will be able to write emails, descriptions of procedures and processes, as well as lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.
2. **General Objective:** Accurately construct a one-page lab report introduction by including the what and the why of a study or experiment for informative purposes.

Specific objectives: By the end of the lesson, students will be able to:

1. Identify commonly used verbs when describing lab experiments by playing a guessing TPR game.
2. Write a manual for a machine by completing all the necessary parts of the manual using imperatives correctly.
3. Accurately identify the correct use of imperatives by correcting mistakes in manuals and by using imperatives correctly in grammar exercises.
4. Define what a lab report is and list its different parts by answering a few questions about it.
5. Identify the purpose of the different sections of a lab report by working on a matching activity.
6. Identify the meaning of linking words and lab reports vocabulary related to lab reports by playing a betting game and analyzing contextual clues.
7. Distinguish each part of a lab report by labeling them based on the functions and contained information.
8. Determine the relationship between ideas by connecting them with the most suitable linking word or phrase.

Obj.	Procedures	Language	Strategies	Macro Skills	Time alloted
Part 1(General objective 2): Sections to be finished from last week on manual writing.					
1	**Warm-up:** Sts get in pairs. They will participate in a trivia against another pair to reinforce the meaning of verbs they will use for the completion of the next	**Key Language for task** actuate, aim, fire, release, swivel, synchronize, reclaim, connect, release, compress,			

	activities. The definition of a verb will be projected as well as three options. Teams negotiate the answer and when ready they ring the bell in order to answer first. Each correct answer is worth a point. Pronunciation of all the verbs will be addressed as a whole class.	supply, check, reclaim, replace, refill, accelerate, stop, open, set, reset, switch, pump, lock, inject. **Useful language** That is______ (verb). That's the definition for_____(verb).	Associating concepts	R W S	10
2	**Task:** In the same pairs, Ss create a short manual or guide describing the procedures for the appropriate use of a machine or mechanical equipment of their choice, or based on the process flow diagram. **Planning:** A manual template is presented to sts and different parts are checked in order to clarify questions. They write the manual in the template (handout # 5) and verify they have included all necessary information. **Report:** Manuals are pasted around the class for other groups to do a supervising round and "evaluate the manual using the evaluation forms (handout # 6) They report ranking in small groups and discuss choices.	**Key Language for task** Sequencers, imperatives, ordinal numbers, machine parts, technical expressions, and symbols for mechanical engineering processes and steps. **E.g.:** *Check ON/OFF status trough using a LED display.* *Make sure that the power supply is off while wiring.* **Useful language (Manual writing)** -What is the first step? -This step is first, second, etc -The safety precautions are… -We need to write … -__is 1st, 2nd, etc. - First, then, next, after, before, **Useful language (Manual evaluation)** Let's give this manual __ stars in this section because... I think the manual is _____ because…	Using graphic organizers Using mechanical techniques	W S L R	45 min
	Post-task:	**Key Language for task**			

3	**Language Focus: A.** Ss go back to the material they used during pre-task and have to highlight verbs that give instructions and circle words that indicate order. **B.** Use of imperatives and sequencers is explained and discussed. Pronunciation for TH in ordinal numbers is addressed as well. **Analysis:** Ss check manuals created and analyze the use of imperatives in the manuals. **Practice:** Ss work on the correction of imperatives in their manuals and practice pronunciation of ordinal numbers in them as well.	Imperatives, sequencers, ordinal numbers. **E.g.:** *Second, remove the discharge needle from the rear of the main unit.* *After cleaning the discharge needle, mount it.*	Skimming	R S	20 min
Part 2 (General objective 3): Lab Report Introduction Writing					
4	**Schema Activation:** Sts discuss the question: What is a lab report? Then sts are shown a definition of lab report for them to compare. What are the different parts? What is the purpose? What is the audience?	**Key Language for task** Introduction, methods, Results, discussion. **Useful language**		S L	5 min
5	**Pre-task 1:** A. Sts get in groups of four people. T will paste on their backs the names of the different sections of a lab report. They stand up and make a line that follows the correct order of those sections in the report. B. Sts use the paper slips from the previous activity and match them with the papers containing the purpose of each of the sections in the report. Everything is glued on a piece of newsprint paper. They visit another group's work station and check if	**Key Language for task** Introduction, methods, Results, discussion. Experiment, equation, summarize, explain, purpose, question, develop. Infinitives of purpose: "This section is written <u>to explain</u> and interpret your results". **Useful language**	Skimming Associating concepts	R S	10 min

	their answers are similar. Then, everything is checked as a whole class. Handout 1.	I think this section is developed to… The______ includes… I agree/disagree Our matches are similar/different because...			
6	**Pre-task 2:** A. Vocabulary betting game. Sts will work in small groups to bet on correct definitions of words. They will look at the sentences projected on the board for them to write a short definition of the word in bold based on their background knowledge and on the information the context provides. After a few minutes, sts bet on their definition the amount of money of their choice. Answers are revealed and money from bets is collected. Sts with more money win. Sts are provided with **glossary # 5** once the game is over. B. Sts work on handout # 2 to identify the uses of the linking words in bold in each of the lines. Sts are provided with the **writing aid** in order to check answers and look at more examples and tips for lab report writing.	**Key Language for task** Mass flow rate, flat, insulation, rotameter, flux, rig, thermocouples, inlet, outlet, assay, mount, slide, ease, wax, saw, deflection, compliance, plot, length, linearize, lift, dislodge, thermal lag, shield, thermometer, roughness, trade-off, quenching. Linking words: Thus, it is recommended that a higher range of flow rates be tested. **Useful language** I think this means... I bet $ _____ on my definition What's your bet? Let's make our bets!	Associating concepts	R W S	20 min

Handout 5

Instructions: Create a short manual or guide describing the procedures for the appropriate use of a machine or mechanical equipment of your choice.

Operation manual

Equipment/ machine:					
Created By		**Document No.**			
Initial Issue Date		**Current Version**		**Next Review Date**	
HAZARDS:	*(List all the potential hazards and associated consequence, e.g. accident prevention, injuries).*				
SAFETY CONTROLS:	*(e.g. emergency equipment, machine guarding, specific personal protective equipment requirements, first aid response, any after-hours work restrictions or rules)*				
PRESTART REQUIREMENTS:	*(List tasks to be completed before operation, e.g. conduct a prestart safety check of equipment, risk assessment or lab rules, prepare work area, equipment and/or operator)*				
INSTRUCTIONS:	*(List step-by-step procedures for the operation. You can use illustrations, flow charts, diagrams etc.)*				

SHUT DOWN PROCEDURES:	*(List procedures to shut down of equipment)*
EMERGENCY PROCEDURES:	*(Emergency response procedures e.g. power isolation procedures, first aid response)*
FURTHER INFORMATION:	*(e.g. relevant legislation, definitions, reference to other safety information)*

APPROVALS			
Title	**Name**	**Signature**	**Date**
Supervisor			
Safety Officer			

Handout 6

Part I. Instructions: Check two other manuals and evaluate them using the form below.

Manual Evaluation Form **Machine:** ____________________			
Manual is complete in all sections:	○○○○○		
Each section contains all necessary info:	○○○○○		
The info in each section is correct:	○○○○○		
Clarity of the steps:	○○○○○		
Order of the steps is correct:	○○○○○		
Names of processes are correct:	○○○○○		
Names or machine parts is correct:	○○○○○		
Is the manual approved?	**Yes**	**No**	**Maybe**
Justification: Write 3 reasons to support your choice.			
1 Star = Incomplete/ Incorrect **2-4 Stars** = Average **5 Stars** = Complete / Correct			

Manual Evaluation Form **Machine:** ____________________			
Manual is complete in all sections:	○○○○○		
Each section contains all necessary info:	○○○○○		
The info in each section is correct:	○○○○○		
Clarity of the steps:	○○○○○		
Order of the steps is correct:	○○○○○		
Names of processes are correct:	○○○○○		
Names or machine parts is correct:	○○○○○		
Is the manual approved?	**Yes**	**No**	**Maybe**
Justification: Write 3 reasons to support your choice.			
1 Star = Incomplete/ Incorrect **2-4 Stars** = Average **5 Stars** = Complete / Correct			

Part II. Instructions: Meet with another group and share your evaluation forms. After discussing and commenting, choose the manual with the highest ranking and report your choice to other class members.

Handout 1

Part 1. Instructions: Stand up and make a line that follows the correct order of the sections of a lab report.

Introduction
Methods
Results
Discussion

Introduction
Methods
Results
Discussion

A. In this section, you present what you found out in your experiment. Tables, graphs, and equations are used <u>to summarize</u> the results. Link equations and visuals together with narrative, like a story. Remember your audience.

B. This section is written <u>to explain</u> and interpret your results. Insert your opinion, backed by results. Discuss issues you had and how this could be corrected in the future. The conclusion is a summary of your results and discussion.

C. In this section, you describe what you are trying to find and why. Background and motivation are used <u>to provide</u> the reader with a reason to read the report.

D. This section is developed <u>to explain</u> how the question addressed is answered. Clearly explain your work so it could be repeated.

ANSWER KEY

- **Introduction**

C. In this section, you describe what you are trying to find and why. Background and motivation are used to provide the reader with a reason to read the report.

- **Methods**

D. This section is developed to explain how the question addressed is answered. Clearly explain your work so it could be repeated.

- **Results**

A. In this section, you present what you found out in your experiment. Tables, graphs, and equations are used to summarize the results. Link equations and visuals together with narrative, like a story. Remember your audience.

- **Discussion**

B. This section is written to explain and interpret your results. Insert your opinion, backed by results. Discuss issues you had and how this could be corrected in the future.

The conclusion is a summary of your results and discussion.

Adapted from:

http://www.me.umn.edu/education/undergraduate/writing/MESWG-Lab.1.5.pdf

Handout 2

Part 1: *Instructions:* Look at the ideas projected on the board and use the context to guess the meaning of the words in bold. Write a short definition for each of the words and bet money depending on how certain you are about your definition.

Part 2: *Instructions:* Look at the ideas below and pay close attention to the words in bold. Choose one of the uses from the box below and write the number in the gear next to each idea.

A. **Besides**, the data suggests that an efficiency of over 80% is achievable.

B. Solar lamps will be used to model the incident radiation received by solar heaters from the sun. **However,** it is not possible to reproduce the uniform radiation flux at the surface of a real collector.

C. It is not possible to reproduce the uniform radiation flux at the surface of a real collector. T**herefore,** the average radiation flux at the surface of the collector will be used in calculations.

D. **For instance**, the R_k family of parameters is used mainly for cylinder bore linings.

E. Many students here are familiar with the IMRaD format for report writing. **In fact**, it is used by many universities in the USA.

F. Please use the traditional format for report writing; **in other words**, go for the IMRaD format.

G. **Thus**, it is recommended that a higher range of flow rates be tested

1. To add an idea	4. To indicate result (x2)
2. To illustrate	5. To explain or restate
3. To show contrast	6. To emphasize

ANSWER KEY

Part 1: *Instructions:* Look at the ideas projected on the board and use the context to guess the meaning of the words in bold. Write a short definition for each of the words and bet money depending on how certain you are about your definition.

Part 2: *Instructions:* Look at the ideas below and pay close attention to the words in bold. Choose one of the uses from the box below and write the number in the gear next to each idea.

H. **Besides**, the data suggests that an efficiency of over 80% is achievable. 1

I. Solar lamps will be used to model the incident radiation received by solar heaters from the sun. **However,** it is not possible to reproduce the uniform radiation flux at the surface of a real collector. 3

J. It is not possible to reproduce the uniform radiation flux at the surface of a real collector. T**herefore,** the average radiation flux at the surface of the collector will be used in calculations. 4

K. **For instance**, the *Rk* family of parameters is used mainly for cylinder bore linings. 2

L. Many students here are familiar with the IMRaD format for report writing. **In fact**, it is used by many universities in the USA. 6

M. Please use the traditional format for report writing; **in other words**, go for the IMRaD format. 5

N. **Thus**, it is recommended that a higher range of flow rates be tested 4

1. To add an idea	4. To indicate result (x2)
2. To illustrate	5. To explain or restate
3. To show contrast	6. To emphasize

Date: October 7th, 2019.
Lesson plan # 9.
Teacher in charge: Laura Coto
Assistant: Garyan Rojas

Unit 2: Engineering Production

1. **Unit Goal:** By the end of the unit, students will be able to write emails, descriptions of procedures and processes, as well as lab reports by incorporating technical and formal lexical items and grammar structures properly for each of the written pieces.
2. **General Objective:** Accurately construct a one-page lab report introduction by including the what and the why of a study or experiment for informative purposes.

Specific objectives: By the end of the lesson, students will be able to:

1. Ask and answer questions related to grammar structures studied before by participating in a discussion activity.
2. Describe the purpose of the sections of IMRaD lab reports by discussing in small groups.
3. Recognize the uses of different linking words by comparing answers with a writing aid provided.
4. Distinguish the parts of a lab report introduction by labeling them on a sample introduction.
5. Identify the parts of a lab report by labeling them based on the functions and contained information.
6. Determine the relationship between ideas by connecting them with the most suitable linking word or phrase.
7. Write a concise lab report introduction by analyzing the input provided in the other sections of a lab report.

Obj.	Procedures	Language	Strategies	Macro Skills	Time alloted
Part 1: Grammar test.					
1	**Warm up and test review:** Sts work in pairs discussing the questions projected on the board. Then, they are given the chance to ask the teacher any questions or clarify any doubts. *Questions:*	**Key Language for task** Present simple Past simple Active voice Passive Voice		S	10

	1. When do we use ideas in present? In past? 2. What is the difference between active and passive voice? Give examples 3. When do we use passive voice? Active voice? 4. What is the meaning and use of each modal? Give examples. 5. When do we use imperatives? Give examples **Sts take the grammar test**	**Useful language** We use____ when…. The difference is…. For example, / For instance….	Using memory for retrieval	L R W	60 minutes
Part 2: Follow up from previous class. *Note:* Schema activation and pre-tasks # 1- # 2 were done last class					
2	**Schema activation /Last class follow up:** Sts discuss the questions on the board. Last class we started working on lab reports. What is the format we studied? What is the meaning of the letters? What are the different sections? Which section will be the focus of today's class?	**Key Language for task** Introduction, Methods, Results, Discussion. **Useful language** The sections are...	Using memory for retrieval	S	5 minutes
3 4	**Homework is checked:** In order to check handout # 2, sts first compare answers with a partner. Then, they are provided the **writing aid** and check. Finally, answers are checked as a whole class. In order to check handout # 3 (part 2) sts compare their answers with a partner. They are then projected the answers on the board and check as a whole class.	**Key Language for task** Linking words. E.g.: *Besides*, the data suggests that an efficiency of over 80% is achievable. Sections of an introduction **Useful language** What number did you write for letter A? What is the answer for letter A?	Associating concepts	S R	10 minutes

		I think the correct answer is...			
5	**Pre-task 3:** A. Sts are given the unlabeled sections of a lab report cut into pieces (handout # 3 Part A). They have to identify the clues that can tell them what the purpose of each section is in order to label each of the sections and to put them in the corresponding order for an IMRaD lab report. B. Sts focus on the introduction. The try to identify the functions of the different parts of the introduction using the homework handout as reference. C. Sts are given 2 sample introductions of different lab reports and try to identify the sections indicated before. They can suggest ways of improving the introductions if necessary.	**Key Language for task** Introduction, methods, results, discussion. Parts of an introduction **Useful language** This section mentions/ includes… I think this part is the… In this section the author … The function of this section is to...	Using context clues	R S	20 min
6	**Pre-task 4:** Sts go back to the writing aid with linking words including their functions and sample sentences as well as the uses of commas, semicolons, and periods. They study the material and then work on writing connected sentences for lab report introductions by using linking words to put them together (handout # 4). Answers are compared with a partner and then the exercise is checked as a whole class.	**Key Language for task** Introduction, methods, results, discussion. Linking words: *However*, there is an optimal angle of attack after which the lift will begin to decrease. **Useful language** The connecting word/phrase is_______ because… The order should be...	Using linguistic clues	R W S L	15 min

7	**Task:** Using the information in the lab report sts were sent via email last week (which is missing the introduction) sts work individually to write the lab introduction following the recommendations and punctuation tips as well as including at least 4 linking words/phrases. **Planning:** *Peer editing.* Sts get in pairs or groups of three and exchange their introductions. They need to use the checklist (handout # 5) in order to identify strengths and improvement opportunities in their partner's introduction. **Report:** Sts share their feedback with peers and make adjustments to their introductions as necessary. They then hand in the introductions for teachers to collect them in order to provide feedback over the week.	**Key Language for task** Linking words. E.g.: Therefore, in addition, however, etc. Vocabulary related to thermodynamics **Useful language** I think you can change this part because I suggest modifying this word because… This part is very effective because... You are missing the ____	Organizational planning	W R S L	30 (Just task. Planning and report will be done next class)
	Post-task: **Language focus:** Sts go back to three specific texts they worked with in the previous session and answer orally a question about each. The answers to these questions will be the purpose for which something was done according to the information given. Once sts are ready, the answers are projected and students are asked which phrase is indicating purpose. **Analysis:** T goes over the use of infinitives of purpose and also addressed the reduced form of "to" - [tə]. **Practice:**	**Key Language for Task** **Useful Language**	Using linguistic clues	R S W	20

	A. Individually, sts work on a grammar exercise in which they change a series of sentences to rephrase the idea in a way that an infinitive of purpose is used. B. Sts practice the reduced for of “to” with the sentences from the grammar practice.				

Handout 3

Part I. *Instructions:* Put the following lab report sections in order as it corresponds for an IMRaD lab report: Introduction, Methods, Results, and Discussion.

<u>Introduction</u>

The use of solar water heaters is rapidly increasing in both homes and businesses as they provide an environmentally friendly and cost effective source of energy. However, significant improvement to their heating efficiency is required before they can be used without a supplementary energy source. This experiment investigates two factors affecting the heating efficiency of solar water heaters: mass flow rate and collector design. Firstly, the efficiency of a flat plate collector (Figure 1) is examined by measuring the temperature of the absorber plate, insulation and water at various flow rates using a rotameter to control the rate of water input into the collector. Secondly, two different methods of welding the water tubes to the absorber plate are tested...

The thermal efficiency of a solar collector is defined as:

$$\eta = \frac{\dot{m}c_p(T_o T_i)}{G_T A}$$

where m = mass flow rate of the working fluid through the collector (kg/s)

c_p = specific heat of the working fluid (J/kg.K)

T_i T_o = inlet and outlet temperatures of the working fluid (°C or K)

G_T = incident solar radiation flux (W/m^2)

A = aperture area of the collector (m^2)

Solar lamps will be used to model the incident radiation received by solar heaters from the sun. However, it is not possible to reproduce the uniform radiation flux at the surface of a real collector. Therefore the average radiation flux at the surface of the collector will be used in calculations.

Method

The performance of a flat plate solar collector was analysed using a small scale test rig. The rig was as shown in Figure 3, with the exception of the water pipes (see Figure 4). Thermocouples were connected to the collector as shown in Figure 3, and attached at the inlet and outlet of the water pipes to measure ambient temperature.

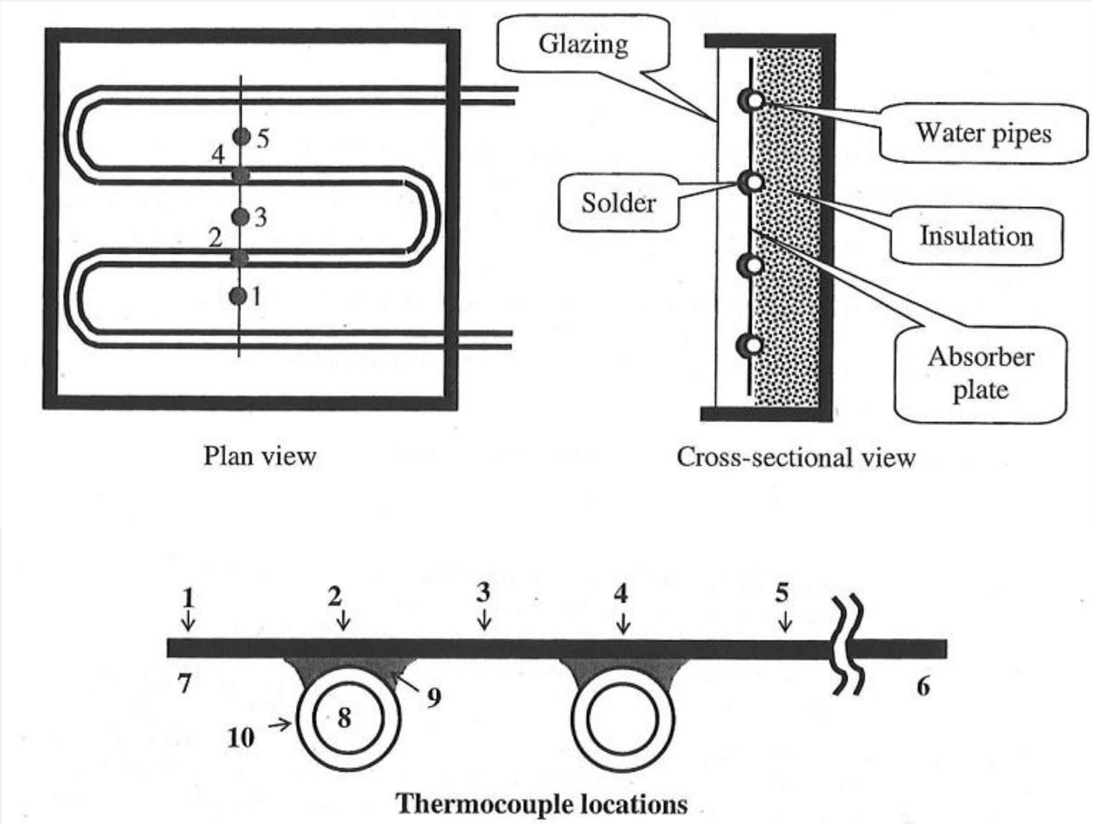


Figure 3. Flat plate solar collector setup

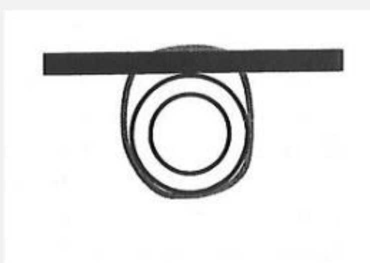


Figure 4. Wired joint

The samples were prepared by cutting square tiles with side lengths of ~5mm from a 1mm x 50mm x 50mm sheet of 99.9999+% (6N) pure aluminium, purchased from Company X (see appendix for a chemical assay). The tiles cut from this sheet were then mounted onto glass microscope slides with thermal wax in order to provide sufficient support and for ease of mounting into a wire saw.

Results

Six specimens of Perspex were tested to three loads (see Appendix 1) and the corresponding deflection calculated. The average compliance at each crack length was calculated and is plotted in Graph 1. To calculate the fracture toughness of Perspex the derivate of 2λ with respect to α is required. Linearizing Graph 1 allows an expression between compliance and crack length to be modelled. The linearized relation form of the relationship allows the power law relationship to be determined.

$$2\lambda = Aa^m$$

$$\log 2\lambda = \log Aa^m$$

$$\log 2\lambda = \log A + m\log a$$

where

m = gradient of linearization

Log A = intercept of linearization

Varying the angle of attack in the positive direction increased the lift until the wind reached an angle of attack of 10°, after which it decreased. This is consistent with the standard trend [3].

The values found for the pressure coefficients around the cylinder (graph 5) are consistent with the accepted trend for laminar flow (graph 6). The sudden increase in the pressure coefficient at 190° is due to the cylinder becoming dislodged from its position perpendicular to the flow.

Discussion

Table 1 shows that the absolute temperature was 1.50-23.80% lower than the actual temperature for the first 30 minutes. This can be attributed to thermal lag due to the effect of the protective shield over the platinum resistance thermometer. This causes a time delay while the thermometer reaches the temperature of the fluid. The actual temperature curve for the heating and cooling sections (Figure 1) is approximately linear. Figure 2 shows that the saturation pressure increased as the temperature increased. Both of these results are as expected. However, it was also expected that the trends for heating and cooling should coincide, but this was not the case. Once more the discrepancy can be attributed to thermal lag, which was a major source of error in this experiment. In future this effect could be reduced by using the thinnest possible platinum shielding or by heating the water more slowly.

Part 2. *Instructions*: Study the following introduction of a lab report in order to analyze the different parts and their function. Then in each box on the right write the number of the piece of information that corresponds to section of the introduction. Use the information below the introduction.

Hume 1

Introduction

A fundamental concept in mechanical engineering is the first law of thermodynamics, which states that internal energy is conserved in a control volume. This law has many applications in engineering, such as: heat exchangers, pumps, turbines, HVAC mixing and refrigeration cycles. It is used to understand the states of fluids as they enter or leave a control volume. The general form of the first law is Equation 1.

$$\frac{dE}{dt} = \dot{Q} - \dot{W} + \sum_{in} \dot{m}_{in}\left(h_{in} + \frac{V_{in}^{\ 2}}{2} + gz_{in}\right) - \sum_{out} \dot{m}_{out}\left(h_{out} + \frac{V_{out}^{2}}{2} + gz_{out}\right)$$

Equation 1: First Law

This energy balance states that heat transfer into a system ($\dot{Q}$) less the work out of a system ($\dot{W}$) plus the mass flow out ($\dot{m}_e$) times its internal energy less the mass flow in ($\dot{m}_i$) times its internal energy is equal to the energy storage term ($\frac{dE}{dt}$).

In this experiment, the first law of thermodynamics will be used with an electric water heater to answer the research question, "What size electric element is used in a given water electric heater?" We hypothesize it will be close to 1 kW, which is the approximate average of most other water heaters of similar size and shape.

1. Purpose
2. Discovery / Research question
3. Background theory
4. Governing equations
5. Name / page #

6. Information for people to continue reading

7. Equations are numbered and explained

8. Equations are separated from the text for emphasis.

Part 3. *Instructions*: Check the following two introductions and try to identify the previous parts and /or purposes. You can draw lines or arrows to indicate the different parts if necessary.

INTRODUCTION 1

ROUGHNESS MEASUREMENTS

Objectives

1. To expose student about surface roughness measurement theory.

1.Introduction

Roughness is a measure of the texture of a surface. It is quantified by the vertical deviations of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small the surface is smooth. Roughness is typically considered to be the high frequency, short wavelength component of a measured surface (see surface metrology).Roughness plays an important role in determining how a real object will interact with its environment. Rough surfaces usually wear more quickly and have higher friction coefficients than smooth surfaces. Roughness is often a good predictor of the performance of a mechanical component, since irregularities in the surface may form nucleation sites for cracks or corrosion. Although roughness is usually undesirable, it is difficult and expensive to control in manufacturing. Decreasing the roughness of a surface will usually increase exponentially its manufacturing costs. This often results in a trade-off between the manufacturing cost of a component and its performance in application.

JOMINY HARDENABILITY TEST

Objectives

1. Introduce students to the concepts of hardenability
2. Demonstrate hardenability in a steel
3. Display the effects on microstructure of the hardening process
4. Provide instruction for a full lab experiment on hardenability (if equipment is available)

1.Introduction

The hardenability of a steel is defined as that property which determines the depth and distribution of hardness induced by quenching ftom the austenitic condition. The dependence of hardness upon quenching rate can be understood ftom the time-temperature-transformation characteristics of steel, and, for a particular steel, can be estimated from the T-T-T diagram.

A part may be hardened by quenching into water, oil, or other suitable medium. The surface of the part is cooled rapidly, resulting in high hardness, whereas the interior cools more slowly and is not hardened. Because of the nature of the T-T-T diagram, the hardness does not vary linearly from the outside to the center. Hardenability refers to capacity of hardening (depth) rather than to maximum attainable hardness.

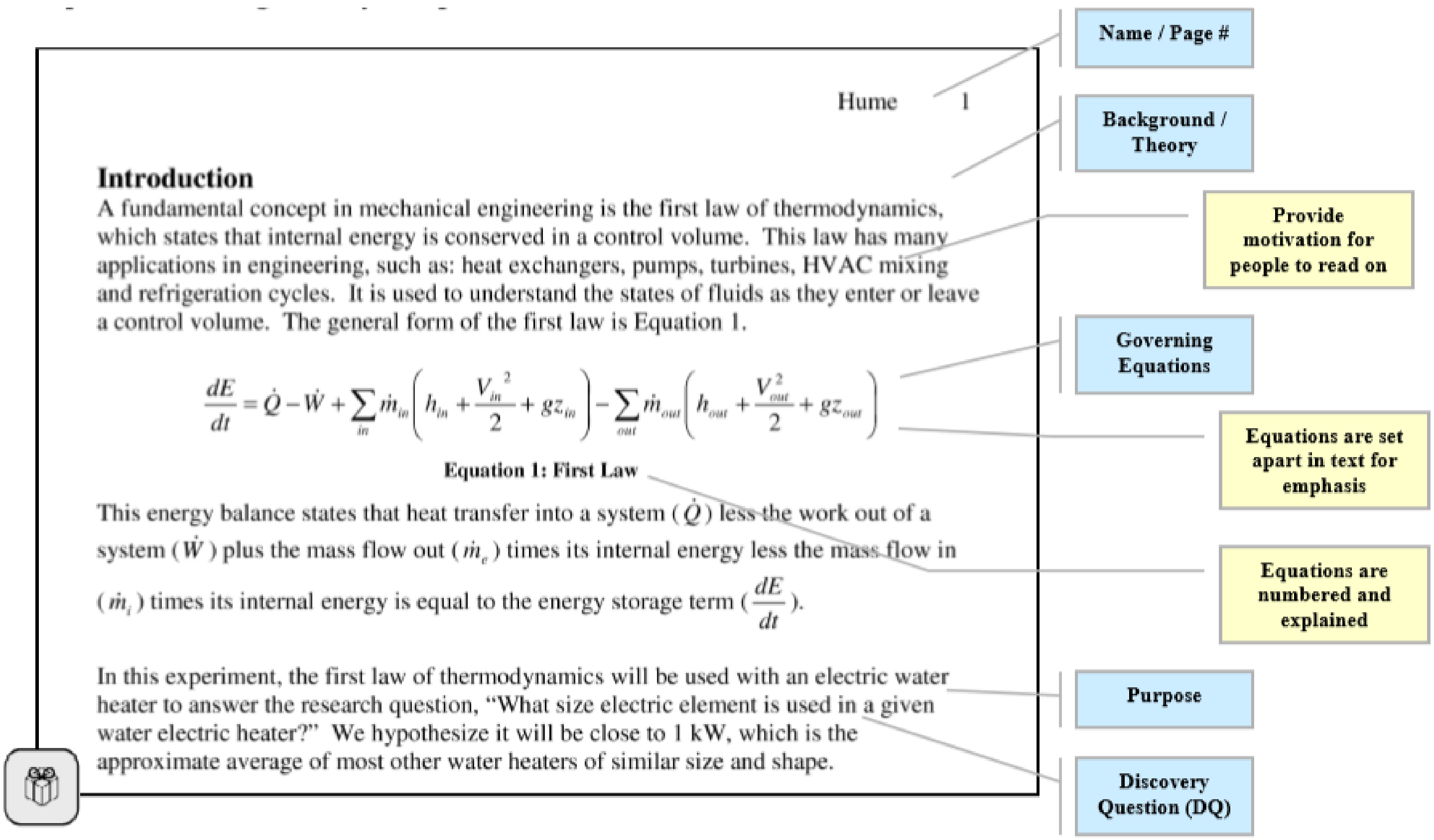
The hardenability of a steel depends on

(1) the composition of the steel,

(2) the austenitic grain size, and

(3) the structure of the steel before quenching.

Answer Key for part 2



Hume 1

Introduction

A fundamental concept in mechanical engineering is the first law of thermodynamics, which states that internal energy is conserved in a control volume. This law has many applications in engineering, such as: heat exchangers, pumps, turbines, HVAC mixing and refrigeration cycles. It is used to understand the states of fluids as they enter or leave a control volume. The general form of the first law is Equation 1.

$$\frac{dE}{dt} = \dot{Q} - \dot{W} + \sum_{in} \dot{m}_{in}\left(h_{in} + \frac{V_{in}^{\ 2}}{2} + gz_{in}\right) - \sum_{out} \dot{m}_{out}\left(h_{out} + \frac{V_{out}^{2}}{2} + gz_{out}\right)$$

Equation 1: First Law

This energy balance states that heat transfer into a system ($\dot{Q}$) less the work out of a system ($\dot{W}$) plus the mass flow out ($\dot{m}_e$) times its internal energy less the mass flow in ($\dot{m}_i$) times its internal energy is equal to the energy storage term ($\frac{dE}{dt}$).

In this experiment, the first law of thermodynamics will be used with an electric water heater to answer the research question, "What size electric element is used in a given water electric heater?" We hypothesize it will be close to 1 kW, which is the approximate average of most other water heaters of similar size and shape.

Handout 4. Instructions. Connect the sentences below by using the appropriate linking word from the box. Write the complete information in the lines.

In addition **However**	-as the angle of attack increased, so too did the lift force exerted on the plane from the aerofoil wings. -there is an optimal angle of attack after which the lift will begin to decrease. ____ ____
Therefore **That is**	-It is recommended that a higher range of flow rates be tested. -The optimal efficiency point obtained for this design was at the highest water mass flow tested, 0.095kg/s, suggesting that the actual optimum may be higher. ____ ____
In contrast **Thus**	-refrigerants are used in the heat pump applications. -mechanical compressor vapor compression heat pump system works according to the compression-condensation and expansion vaporization principles likewise mechanical compressor vapor compression refrigeration machine. ____ ____ ____
For example **Similarly**	-Amplitude parameters characterize the surface based on the vertical deviations of the roughness profile from the mean line. Many of them are closely related to the parameters found in statistics for characterizing population samples. -Ra is the arithmetic average of the absolute values and Rt is the range of the collected roughness data points. ____ ____ ____
Indeed **Consequently**	-More and more of it is wasted and this explained variation of heat flow from theoretical value. - The second law also states that the changes in the entropy in the universe can never be negative. ____ ____

ANSWER KEY

Instructions. Connect the sentences given using the appropriate linking word from the box.

1. As the angle of attack increased, so too did the lift force exerted on the plane from the aerofoil wings. **However**, there is an optimal angle of attack after which the lift will begin to decrease.

2. The optimal efficiency point obtained for this design was at the highest water mass flow tested, 0.095kg/s, suggesting that the actual optimum may be higher. **Therefore**, it is recommended that a higher range of flow rates be tested.

3. Mechanical compressor vapor compression heat pump system works according to the compression-condensation and expansion vaporization principles likewise mechanical compressor vapor compression refrigeration machine. **Thus**, refrigerants are used in the heat pump applications

4. Amplitude parameters characterize the surface based on the vertical deviations of the roughness profile from the mean line. Many of them are closely related to the parameters found in statistics for characterizing population samples. **For example**, Ra is the arithmetic average of the absolute values and Rt is the range of the collected roughness data points.

5. The second law also states that the changes in the entropy in the universe can never be negative. **Consequently**, more and more of it is wasted and this explained variation of heat flow from theoretical value.

Handout 5

Instructions:

I. Rewrite the sentences using infinitives of purpose. The idea must remain the same.

1. We should stabilize the reading for the equipment first because we want to minimize the error.
   ____.

2. If you want to relate temperature difference, heat flow and distance in a solid material, the Fourier equation is valid.
   ____.

3. If you want to calculate the constant, use the same equation.
   ____.

4. Reading this section can help the reader if he wants to reproduce the experiment.
   ____.

II. Answer the following question.

Why did you decide to become a mechanical engineer?

____
____
____.

Writing Aid

1. Connectors/Linking Words

✓ These words help us build relationships of different kinds between ideas. Look at the uses and examples below:

Use	Linking words	Examples
To add an idea	*Also* *Moreover* *In addition* *Besides*	The data **also** suggests that an efficiency of over 80% is achievable. **Moreover/ Also / In addition/ Besides,** the data suggests that an efficiency of over 80% is achievable.
To show contrast	*However* *On the other hand* *In contrast* *On the contrary*	As the angle of attack increased, so too did the lift force exerted on the plane from the aerofoil wings. **However / On the other hand/ In contrast / On the contrary**, there is an optimal angle of attack after which the lift will begin to decrease.
To show similarity	*Similarly* *Likewise*	**Likewise / Similarly**, the mechanical compressor vapor compression heat pump system works according to the compression-condensation and expansion-vaporization principles.
To indicate result	*Therefore* *As a result* *Thus* *Consequently*	It is **therefore** recommended that a higher range of flow rates be tested. **Therefore / As a result / Thus / Consequently**, it is recommended that a higher range of flow rates be tested.
To give an example	*For example* *For instance*	**For example / For instance**, the R_k family of parameters is used mainly for cylinder bore linings.
To emphasize or intensify	*In fact* *Indeed*	Many students here are familiar with the IMRaD format for report writing. **In fact**, it is used by many universities in the USA. The IMRaD format for report writing is used by many universities in the USA **indeed**.
To explain or restate	*That is* *In other words*	Please use the traditional format for report writing; **in other words**, go for the IMRaD format. Please use the traditional format for report writing. **That is**, go for the IMRaD format.
To summarize	*In conclusion* *In summary*	**In conclusion / In summary**, the most efficient of the two collector designs tested was the formed fully soldered joint, due to the greater contact area between collector and pipe maximizing heat transfer to the fluid.

Summary of Connecting Words. Adapted from the book Developing Composition Skills by Mary K. Ruetten.

2. Using commas appropriately (,)

Basic Uses	Examples
After an introductory phrase of more than three or four words.	To choose the right device for air conditioning**,** it is needed to calculate heating and cooling loads correctly.
At the beginning and end of a phrase that interrupts the main thought.	In order to obtain reproducible results**,** with good contrast in the image**,** the specimen surface is polished.
To separate items in a series.	Non-contact methods include interferometry**,** confocal microscopy**,** electrical capacitance**,** and electron microscopy.
Before a connecting word (*for, and, nor, but, or, yet*) to link two complete sentences together.	Explain clearly how you obtained final values**, and** tell the reader where to find raw data.

3. Using the semicolon appropriately (;)

Basic Uses	Examples
When you are linking two complete sentences with no connecting words.	The preferential attack is electrochemical corrosion**;** it is well known that different materials corrode at different rates.
When you are linking two complete sentences that are joined, but one has a connecting word in front of it	These range from a form to fill in and submit before leaving the lab, to a formal written report**; however**, they all usually follow a similar basic structure.

4. Using the period appropriately (.)

Basic Uses	Examples
Use a period at the end of a complete sentence that is a statement.	Fracture toughness is a measure of the fracture resistance of a cracked material**.**
Use a period to separate two independent, complete sentences.	The polishing is done on rotating wheels covered by a special cloth**.** Alumina is employed as polishing agent.
If the last item in the sentence is an abbreviation that ends in a period, do not follow it with another period.	The length should be 5 pages max**.**
Question marks and exclamation points replace and eliminate periods at the end of a sentence.	What size electric heating element is installed in a given water heater? (no period needed at the end)

Taken from: https://www.esc.edu/online-writing-center/resources/punctuation/commas/

https://www.grammarbook.com/punctuation/periods.asp

https://www.lynchburg.edu/academics/writing-center/wilmer-writing-center-online-writing-lab/grammar/semicolons/

https://www.monash.edu/rlo/assignment-samples/engineering/laboratory-reports#introduction

https://www.academia.edu/34906233/LAB_REPORT_GUIDE_MECHANICAL_ENGINEERING_DEPARTMENT

Appendix FF. Unit 3 Lesson Plan and Materials

Date: October 7, 2019. Lesson Plan # 10
Teacher in charge: Garyan Rojas
Assistant: Laura Coto

Unit #3: Exchanging Ideas

Unit Goal: By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues and superiors by actively listening, asking questions, and reporting information orally.

General Objective: By the end of the lesson, students will be able to successfully demonstrate understanding of information presented orally by experts and react to it by asking questions and providing appropriate responses.

Specific Objectives: Students will be able to

1. correctly identify infinitives of purpose in by reviewing the function on each section in a lab report. (Follow up on previous lesson).
2. orally share their background knowledge about project design by reacting to a video on the topic.
3. actively brainstorm information about project design by answering questions orally.
4. appropriately identify suitability of questions to ask experts by contrasting question types based on a short video segment.
5. accurately make predictions based on images of a video by completing a KWL chart.
6. properly recognize the meaning of ten words by matching them with their definition.
7. actively show understanding of information given orally by asking and answering questions based on an experts' conference.

to accurately identify the correct use of direct and indirect questions by practicing on a question and answer exercises.

Obj.	Procedures	Language	Strategies	Macro Skills	Time alloted
Part 1: Post-task on lab report introduction writing (Follow up on previous lesson)					
1	**Post-task**: Sts are shown the introduction sample they used last class in which they had to label its different parts. They discuss the following questions: Why is it necessary to write an introduction in a lab report? How does it help the reader? **Language focus:** Sts are shown three specific texts they worked with in the previous session and answer orally a question about each. The answers to these questions will be the purpose for which something was done according to the information given. Once sts are ready, the answers are projected and students are asked which phrase is indicating purpose. **Analysis:** T goes over the use of infinitives of purpose and also addressed the reduced form of "to" - [tə]. **Practice:** A. Individually, sts work on a grammar exercise in which they rephrase a series of sentences in a way that an infinitive of purpose is used. Then they answer an open-ended question. (handout 5) B. B. Sts practice the reduced for of "to" with the sentences from the grammar practice.	**Key Language for Task** Infinitives of purpose E.g.: *The thermocouples were connected to the collector and attached at the inlet and outlet of the water pipes **to measure** ambient temperature.* **Useful Language** What did you write in # _____? I changed the sentence to_____ because the purpose is to...	Using linguistic clues	R S W	20

<table>
<tr><th colspan="6">Part 2: Writing assessment # 1. 30 minutes.</th></tr>
<tr><td colspan="6">Sts have 30 minutes to complete the writing assessment on email responses. They will read a thread of emails and write down an appropriate response based on it.</td></tr>
<tr><th colspan="6">Part 3. Unit 3, Objective 1, first part: listening to expert conferences and participating in a Q&A session.</th></tr>
<tr><td>2</td><td>Warm up:
Sts watch 2 videos and from Boston Dynamics. They share their thoughts with a partner after watching the videos. (The videos feature mechanical engineering inventions and projects).</td><td>Key Language for task
Phrases to express opinions. Eg.: I think…. I believe… In my opinion this is impressive because…
Descriptive words
Eg.: Amazing, interesting, challenging, expensive
Useful language:
What are your thoughts on the video?
What comes to mind after this video?
Did you know about these projects?</td><td>Using visual cues</td><td>S
L</td><td>10 min</td></tr>
<tr><td>3</td><td>Schema activation: A. Ss ask each other questions about project design and about intelligent systems using the prompts in handout # 1 as a guide.
B. Sts walk around the class and scan the QR codes in order to listen to 6 questions. They discuss the questions with a partner. (Handout # 1 Part 2)</td><td>Key Language for task
Phrases to express opinions. Eg.: I think…. I believe… In my opinion this is impressive because…
Descriptive words</td><td>Using back channel clues</td><td>S
L
R</td><td>15</td></tr>
</table>

		Eg.: Amazing, interesting, challenging, expensive **Useful language** -What is your opinion (about project design)? -Are you interested in (Intelligent systems)? -What do you know about (intelligent systems)?			
4	**Pre task # 1: A.** Ss watch a one-minute segment of a video about Q&A session in mute and in pairs have to discuss the two questions on the board. (What is happening in the video? What is the presenter talking about?) (to elicit Q&A session with an expert on a project). **B**. Then they watch the video again with audio and have to choose from the options on the board, the options that contain a possible/ appropriate question asked by the audience. **C.** Sts discuss the question on the board about the difference between the previous questions. <u>Options for the PPT</u> 1. Why is this important? 2. How did you do this? 3. I would like to know what you think are the benefits of this project.	**Key Language for task** *Project design vocabulary.* Eg.: Prototype *Indirect questions.* Eg.: Can you please explain what the main advantages of this project are? **Useful language:** Based on the video I think he is… If I am not wrong the people are… # 3 is (not) appropriate because...	For the mute section: Making predictions For the audio section: Listening for details	L S W	10 min

	4. Can you please explain what the main advantages of this project are? *Source:* https://www.youtube.com/watch?v=XSZX6vH7r7Q				
5	**Pre task # 2: A.** Ss look at 4 screenshots of another video and have to predict what they think the video will be about. (Handout # 2). They comment predictions with a partner using the questions in part II of the handout as a guide. **B.** Sts work on columns 1 and 2 of the KWL chart. In order to check, teacher writes on the board these questions Ss created. (Handout # 2, part III)	**Key Language for task** *Question words* Eg.: Who, why, what, which **Useful language:** -I believe the video is about…/ This picture represents.../I want to know/ I would like to know.../About this topic what I know is…	Making predictions	L S W	20 min
6	**Pre task # 3:** Each st gets a piece of paper with the definition of a word related to the video, project design, and intelligent systems. All sts get a handout with words. They need to walk around the class and read their definition to classmates so that they are able to match the definitions with one of the words in their handout. (Handout # 3)	**Key Language for task** innovation**,** interface**,** sensor**,** smart system**,** waste**,** applications**,** dims**,** behavior. **Useful language:** -The definition I have says… - Can you please tell me what definition you have? -I want to know what the meaning of ____ is. - Do you know if this match is correct?	Identifying concepts	L S R	15 min

		- Can you please tell me what your definition is?			
7	**Task: A.** Ss listen to a segment of an expert conference while taking notes about information they learn from the video completing the "L" column of the KWL chart. They also try to answer the questions they wrote in the W column with the information from the video. (Handout # 4 part 1) *Source:* *https://www.youtube.com/watch?v=qdLWAHFaPj8* **B.** Students write three questions they would like to ask the presenter using handout # 4 part 2. After this, sts carry out a Q&A session with classmates, one person pretending to be the presenter and other the audience. They base the Q&A session on the video and the information collected in the KWL chart while using the questions they wrote and the useful language provided in handout 4, part 3. **Planning:** Ss assign roles in their teams and organize the necessary information in order to carry out the Q&A session. The session is voice recorded. **Report:** Sts send the recording to another group. Groups listen to their classmates' recording and identify similarities and differences between the two sessions.	**Key Language for task** Direct and indirect questions form, meaning and use. Expressions for indirect questions. **Useful Language:** *Expressions for indirect questions:* I want to know… I wonder… I would like to ask… I need to understand why… Can you please tell me … Would you mind telling me… Could you please let me know… Is it ok if I ask... Do you know… May I ask… May I know… Do you know if…? Do you have any idea if…?	Listening for details Note-taking	L S R W	35

<table>
<tr><th colspan="6">To be completed next class</th></tr>
<tr>
<td>8</td>
<td>Post task

Language focus: Ss go back to the questions in the PPT that they chose from pre-task 1 as well as to the questions created during the task.

What is different in these questions?

What is the difference between if and whether?

They work on parts I-II from handout # 5. Grammar structure for direct and indirect questions is then analyzed; as well as the correct intonation for these questions.

Analysis: Ss listen to the recording of their Q&A session to their own use of questions in order to correct any mistakes. They also analyze the questions they created during all pre-tasks.

Practice: A. Ss work in handout # 6 containing a grammar exercise for the construction of direct and indirect questions. They are encouraged to use whether and if for yes / no questions.

B. Sts create a short dialogue for another Q&A session about any other project they are interested in.</td>
<td>Key Language for task

Direct and indirect questions form, meaning and use.

Expressions for indirect questions.

Useful Language:

Expressions for indirect questions:

I want to know…

I wonder…

I would like to ask…

I need to understand why…

Can you please tell me…

Would you mind telling me…

Could you please let me know…

Is it ok if I ask…

Do you know…

May I ask…

May I know…

Do you know if…?

Do you have any idea if…?</td>
<td>Identifying patterns</td>
<td>R

W

L</td>
<td>20</td>
</tr>
</table>

Abbreviations to be used: T = teacher A = assistant Ss = students L = listening S = speaking R = reading W = writing Others: __________

Handout 1

Part I: *Instructions:* Ask each other questions about project design and intelligent systems. Use the prompts in the gear for inspiration.

-What is your opinion about…?

-Do you like…?

-Are you interested in…?

-Is ______ interesting for you?

-Is_______ important? Why or why not?

-What do you know about…?

-What are the (dis) advantages of _____?

-What is the impact of project design /intelligent systems for a mechanical engineer?

-What intelligent systems are you familiar with?

USEFUL LANGUAGE

- I think...
- In my opinion….
- I find________ interesting because
- I believe ____________is important because
- I am familiar with ___________

Part II: *Instructions:* Discuss the following questions with a partner. Scan the code, listen to the question, and discuss it with a partner.

Where can you learn about project design and/or intelligent systems?

Are there conferences at your university to learn about mechanical engineering projects?

What mechanical engineering conferences do you know about?

Have you ever attended a mechanical engineering conference?

Which international engineering conferences do you know about?

Do you know about any experts in project design or intelligent systems in Costa Rica or in the world?

1

2

3

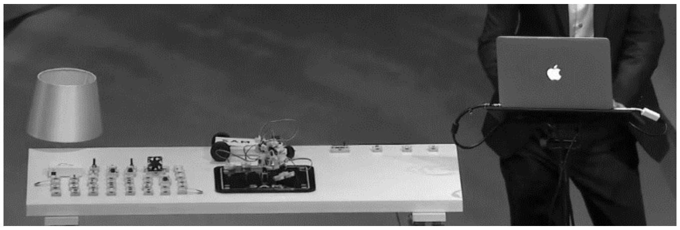
4

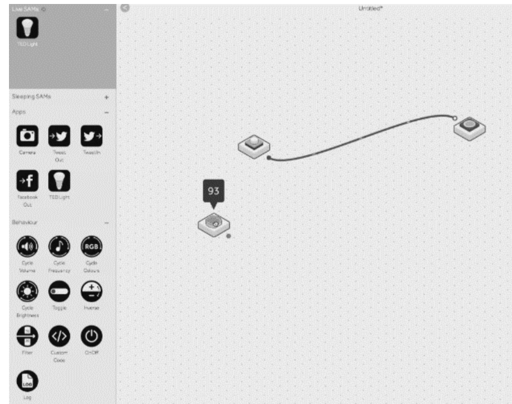
5

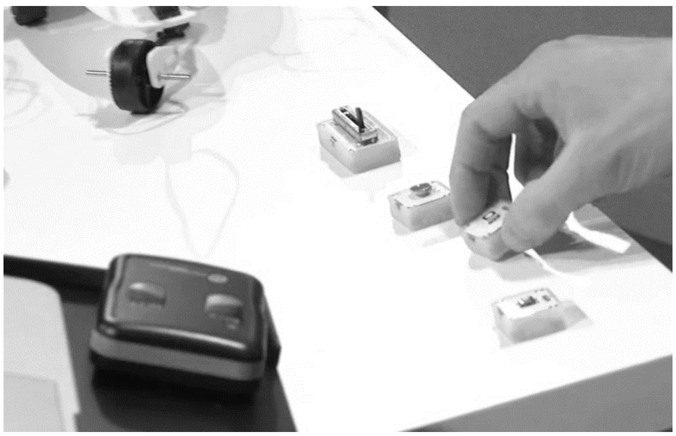
6

Handout 2

Part I: *Instructions:* Look at the pictures taken from a video you will watch. What do you think the video will be about? Write 2-3 predictions.







My predictions:

Part II: *Instructions:* Orally share your predictions with a partner using the questions below. Do you have any similar predictions?

Useful language to compare predictions

- What did you write?
- What is the video about?
- What is he doing?
- What is the object in this picture?
- What is he talking about?
- Where is he?

Part III: *Instructions:* Individually, complete column **K**. Write what you think the video will be about and what you know about the topic. Then in column **W**, write questions that you would like to ask the expert on the topic or questions about what you want to know.

K - What I know	W- What I wonder	L - What I learned

Part IV: *Instructions:* Compare your chart with a partner and discuss similarities and differences in the information. You can complement each other's charts with any ideas obtained from the discussion.

Handout 3

Part 1: *Instructions:* Walk around the class and listen to your partners' definitions for one of the words below. Write **the letter** of the definition you think corresponds to each concept. Careful! There is an extra definition.

1. Innovation _____
2. Waste _____
3. Interface _____
4. Applications _____
5. Prototype _____
6. Sensor ______
7. Dims ______
8. Smart System ______
9. Behavior ______
10. Bright ______

Part 1: *Instructions:* Walk around the class and listen to your partners' definitions for one of the words below. Write **the letter** of the definition you think corresponds to each concept. Careful! There is an extra definition.

1. Innovation _____
2. Waste _____
3. Interface _____
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5. Prototype _____
6. Sensor ______
7. Dims ______
8. Smart System ______
9. Behavior ______
10. Bright ______

Part 1: *Instructions:* Walk around the class and listen to your partners' definitions for one of the words below. Write **the letter** of the definition you think corresponds to each concept. Careful! There is an extra definition.

1. Innovation _____
2. Waste _____
3. Interface _____
4. Applications _____
5. Prototype _____
6. Sensor ______
7. Dims ______
8. Smart System ______
9. Behavior ______
10. Bright ______

Part 1: *Instructions:* Walk around the class and listen to your partners' definitions for one of the words below. Write **the letter** of the definition you think corresponds to each concept. Careful! There is an extra definition.

1. Innovation _____
2. Waste _____
3. Interface _____
4. Applications _____
5. Prototype _____
6. Sensor ______
7. Dims ______
8. Smart System ______
9. Behavior ______
10. Bright ______

Definitions

Retrived from https://www.merriam-webster.com/

A a new idea, method, or device.	**B** a device or program enabling a user to communicate with a computer.	**C** a device that responds to a physical stimulus and transmits a resulting impulse	**D** Incorporation of functions of sensing, actuation, and control in order to describe and analyze a situation, and make decisions based on the available data in a predictive or adaptive manner
E to use too much of something or use something badly	**F** a program that performs a particular task or set of tasks	**G** emitting or having a limited or insufficient amount of light	**H** the way in which something functions or operates
I an original model on which something is patterned	**J** radiating or reflecting light	**K** a mathematical correspondence that assigns exactly one element of one set to each element of the same or another set	

Answer key: 1A / 2E / 3B / 4F / 5 I / 6C / 7G / 8D / 9H/ 10J

Handout 4

Part I. *Instructions*: Watch the video "*A solution for building a generation of inventors*" and complete column **L**. Provide an answer to the questions you stated in column **W** and add additional information on what you learned.

Full video: https://www.youtube.com/watch?v=qdLWAHFaPj8

Part II. *Instructions:* Write down at least three questions you would like to ask the speaker.

a. I would like to know____.
b. I wonder____.
c. Can you please tell me____?
d. Do you mind telling me____?
e. I want to know____.

Part III. *Instructions* Now pretend one of you is the presenter and the rest are the audience. Conduct a Q&A session using the question prompts below.

Useful language

I want to know…	Is it ok if I ask…?
I wonder…	Do you know…
I would like to ask…	May I ask…
I need to understand why…	May I know…
Can you please tell me…?	Do you know if/whether…?
Would you mind telling me…	Do you have any idea if/whether…?
Could you please let me know…?	

Handout 5

Part I: *Instructions.* In the box below, write the expressions that precede the questions from handout 4.

Part II: *Instructions.* Read the two questions below and analyze them. Then provide answers to the analysis questions below.

1	**2**
What is the benefit of this project?	Can you please tell me what the benefit of this project is?

A. What are the differences between the two questions?

___

B. When (in what situations) can you use question 2?

___

C. What difference does it make if you use one question or the other?

___

D. Analyze the information in the box. Is it a sentence or a question? Why?

___

I would like to know what the benefit of this project is.

Handout 6

Part I: *Instructions.* Work on the transformation of these direct questions into indirect questions. You can use the expressions in previous handouts.

Direct question	Indirect question
1. Are you interested in intelligent systems?	
2. What do you know about project design?	
3. What is the impact on this project you?	
4. Where can you install this intelligent system?	
5. Is this project relevant for your company?	
6. Have you developed the parts yet?	
7. Would you change anything in the project?	
8. Will you publish the results of this project?	
9. What can you modify about the system?	
10. Can this be used in all kinds on machinery?	
11. Why did you develop this specific system?	
12. Do you have any plans to create a similar tool?	

Part II: *Instructions.* Create a short dialogue about project design using indirect questions. Record it and send it to your teachers for feedback.

Date: October 28th, 2019.
Lesson plan # 11.
Teacher in charge: Laura Coto.
Assistant: Garyan Rojas.

Unit: 3. Exchanging Ideas

1. **Unit Goal:** By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues and superiors by actively listening, asking questions, and reporting information orally.
2. **General Objective:** Appropriately discuss technical processes with colleagues by sharing their point of view and exchanging ideas in order to find the most suitable solution.

Specific objectives: By the end of the lesson, students will be able to:

1. Actively show understanding of information given orally by asking and answering questions based on an expert's conference. (Last class' follow up).
2. To accurately identify the correct use of direct and indirect questions by practicing in question and answer exercises. (Last class' follow up).
3. Correctly order the steps of project design by numbering them.
4. Accurately match steps of project design with their description by listening to the descriptions.
5. Actively discuss the flow of project design by prompting possible consequences of the different steps.
6. Accurately evaluate options given to solve a problem by analyzing two case studies.
7. Create a project design proposal by addressing a specific need given in a particular scenario.
8. Appropriately use the first conditional by formulating complete sentences in a grammar exercise.

FOLLOW UP FROM PREVIOUS CLASS UNIT 3 OBJECTIVE 1 (ALL PRE-TASKS WERE DONE LAST CLASS)					
Obj.	**Procedures**	**Language**	**Strategies**	**Macro Skills**	**Time allotted**
	**At home students had to watch a video. (*Source:* *https://www.youtube.com/watch?v=qdLWAHFaPj8*) and complete Handout # 4 part 1, taking notes in the "L" column of the KWL chart. They also had to write	**Key Language for task**		L S	

	three questions they would like to ask the presenter using handout # 4 part 2. **In class:** sts carry out a Q&A session with classmates, one person pretending to be the presenter and other the audience. They base the Q&A session on the video and the information collected in the KWL chart while using the questions they wrote and the useful language provided in handout 4 part 3. **Planning:** Ss assign roles in their teams and organize the necessary information in order to carry out the Q&A session. The session is voice recorded. **Report:** (Done digitally) Sts send the recording to another group. Sts listen to their classmates' recording at home and identify similarities and differences between the two sessions. They send their feedback via email to classmates.	Direct and indirect questions form, meaning and use. Expressions for indirect questions. **Useful Language:** *Expressions for indirect questions:* I want to know… I wonder… I would like to ask… I need to understand why… Can you please tell me…? Would you mind telling me… Could you please let me know…? Is it ok if I ask…? Do you know… May I ask… May I know… Do you know if…? Do you have any idea if…?	Listening for details Note-taking	R W	15
	Post task **Language focus:** Ss go back to the questions in the PPT that they chose from pre-task 1 as well as to the questions created during the task.	**Key Language for task** Direct and indirect questions form, meaning and use.	Identifying patterns	R W L	

	What is different in these questions? What is the difference between if and whether? They work on parts I-II from handout # 5. Grammar structure for direct and indirect questions is then analyzed; as well as the correct intonation for these questions. **Analysis:** At home Ss listen to the recording of their Q&A session and pay attention to their own use of questions in order to correct any mistakes. They also analyze the questions they created during all pre-tasks. **Practice:** Ss work in handout # 6 containing a grammar exercise for the construction of direct and indirect questions. They are encouraged to use whether and if for yes / no questions.	Expressions for indirect questions. **Useful Language:** *Expressions for indirect questions:* I *want to know…* *I wonder…* *I would like to ask…* *I need to understand why…* *Can you please tell me…?* *Would you mind telling me…* *Could you please let me know…?* *Is it ok if I ask …?* *Do you know…* *May I ask…* *May I know…* *Do you know if…?* Do you have any idea if…?			10
UNIT 3 OBJECTIVE 2					
Obj.	**Procedures**	**Language**	**Strategies**	**Macro Skills**	**Time alloted**
1	**Warm-up:** Sts work on handout # 1**.** Sts listen to a brief conversation and discuss the questions about the conversation in the handout.	**Key Language for task** *Bumper, collision, approach, shape, flexibility, initiating,*	Inferring	L	

	Schema activation: A. Sts listen to the name of the 5 stages of project design. They need to write them down in their handout # 1 Part 2. **B.** Sts work on part 3 of the handout in order to put the stages in order.	*planning, executing, monitoring, closing.* Sequencers **Useful language** I disagree because... I agree because...	Ordering	S	15
2	**Pre-task 1:** **A. Running dictation:** Sts work in pairs and are assigned roles. Student 1 stays in the room and student 2 goes outside and looks for papers containing descriptions of the steps for project design. Student 2 tries to remember as much information as possible and comes back to the room to dictate the information for student 1 to write it down. They switch roles every time they complete one description. (Only three descriptions will be completed. The other two will be provided to sts because of time constraints) Once they have all descriptions, they match them with one of the stages. Answers are checked as a whole class.	**Key Language for task** Project design vocabulary and stages **Useful language** How do you spell that? Can you please say that again? This description goes with this stage In my opinion… It is necessary to... An additional step is...	Creating mental linkages Analyzing steps	S L R W	10 20
3	**Pre-task 2:** Sts work in handout # 2 analyzing the steps in the diagram and discussing the questions in section 2.	**Key Language for task** First conditional Sequencers	Analyzing steps	S	15

	Sts are provided with a speaking aid with language to express agreement and disagreement.	Project design stages and vocabulary about steps **Useful language** This step corresponds to … First, you have to… If we don't do this, the project will be... The design will be affected if…	Reasoning deductively	L R	
4	**Pre-task 3:** Sts are given two case studies and possible options to solve them. They discuss why the options are suitable or not. Sts are encouraged to use their speaking aid again to express agreement and disagreement. Handout 3.	**Key Language for task** First conditional Sequencers Phrases for agreeing and disagreeing Words related to technical processes: *conveyor, ball bearings, bucket elevator, belt, top/bottom shaft, discharge, chute, centrifugal force.* **Useful language** If we go for option #___, the problem will/might... A feasible alternative is___ (option) because...	Reasoning deductively Analyzing steps	R S	15
	Task: Discuss different points of view on a case studies about mechanical engineering processes and create a project design proposal.	**Key Language for task** First conditional	Negotiating	R	

5	Sts are presented with an issue related to window cleaning which they need to think of a solution for. In small groups sts will come up with a possible way to address the need presented. Handout 4. Planning: Sts organize their ideas in notes including only key words. Reporting: Sts make different expert groups and discuss with colleagues their proposal to solve the problem.	Sequencers Words related to technical processes: *cradle, jibs, story.* **Useful language** What if we…? If we____, we will… If we consider____, then the … will… We came up with the idea of____ (ing)...	Analyzing steps	S L W	25
6	**Post-task (This part will be done next class)** Language focus: Sts go back to the analysis they carried out in pre-task 2 and analyze the type of questions and statements they used to discuss the stages of project design. Sts are asked to identify two key words that are repeated there (if & will). Analysis: Sts and T go over the form, meaning and use of the first conditional. Then, the pronunciation of the /i/ and /ɪ/ is checked. Practice: A. Sts work on a consequence chain. They get a situation (based on the steps of project design) and have to create a chain of consequences. For example: If the prototype is incorrect… B. Sts talk about the project they used during the task and possible scenarios or variations. For example: What will happen if the jib…?	**Key Language for task** First conditional if vs whether Words related to technical processes: *cradle, jibs, story.* **Useful language** *How do you pronounce…?* *What will happen if…?* *If we…, the … will…*	Analyzing steps	R S L W	20

Handout 1

Part 1: *Instructions:* Listen to a conversation between two people. Answer the following questions with a partner.

1. Where can the people possibly be?
2. What is the relationship between them?
3. What are they talking about?
4. What is the problem?
5. What are possible solutions?
6. Who can solve this problem?
7. How can mechanical engineering project design help with this?
8. What is the first step to follow?

Part 2: *Instructions:* Listen to each of the steps of project design (5) and write them down in the lines below.

☐ ___________________________ ☐ ___________________________

☐ ___________________________

☐ ___________________________ ☐ ___________________________

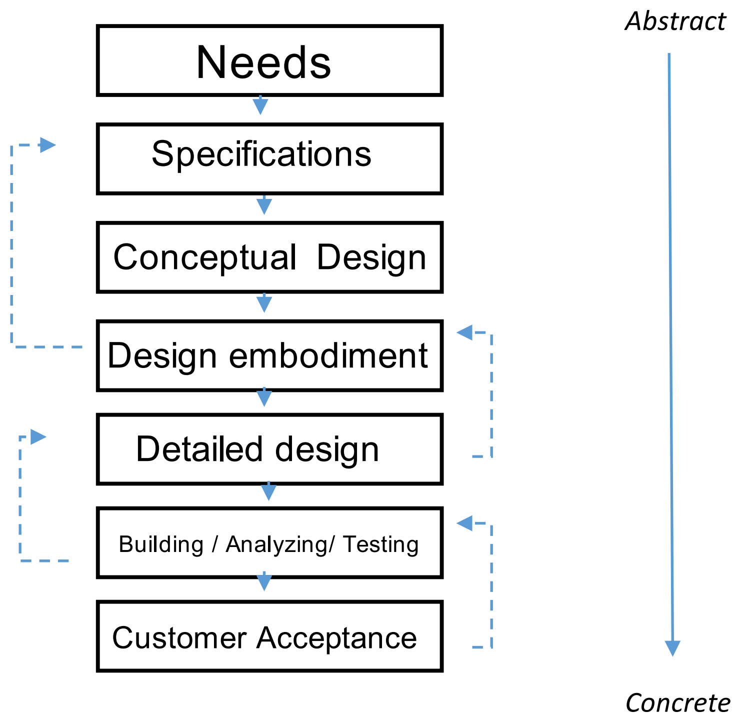
Part 3: *Instructions:* Put the previous steps in the correct order to follow in project design. Write numbers (1-5) next to each line in part 2.

Running dictation materials

Initiating	This stage is generated by the need and it converts the need into a business case or a case study.
Planning	In this stage, engineers develop a solution and prepare to do the work considering the life of the product, the customers, the extension of objectives, protection, and other aspects.
Executing	In this stage few teams usually collaborate and engineers do the detailed design work and fabrication.
Monitoring and control	In this stage problems may come up so engineers watch the project and make necessary changes.
Closing	If everything is correct, approved and well-designed, the project will end in this stage.

Handout 2

Part 1: *Instructions.* Look at the process flow diagram below related to specific steps in one of the stages of project design. Analyze it and comment your understanding with a partner. In which of the five stages discussed before would you insert this process?



Part 2: *Instructions*. Discuss the following questions about the previous flow chart and about the stages of project design. Use the arrows as a guide.

-What might happen if….?

-If we ___________, the project might…..

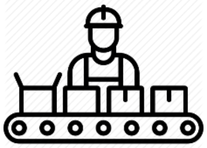
- We may need to go back to _____

-The project might_____________ if we_________________

* one on the steps if not done
* you fail to complete one of the steps
* the specifications are wrong
* the conceptual design is late
* customers don't accept the designs
* the design embodiment is rejected
* the testing gives wrong results
* the detailed design is not well developed

Handout 3

Instructions: Read the following case studies and discuss with your partner what you consider the most suitable solution is and put a √ next to it. Go back to your speaking aid to express agreement or disagreement.



1. Two colleagues are analyzing the maintenance data of a conveyor and they realize that the machine has stopped working quite frequently in the last 2 months. This has an impact on the maintenance costs and also on the production time that is wasted when the machine is out of service. Which of the options would you choose as the most suitable one to solve the problem?

    A. Redesign the entire conveyor system of the machine. ☐

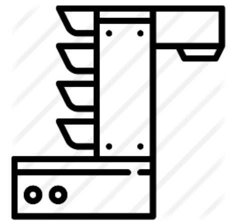
    B. Analyze how the ball bearings are working and decide if they are the appropriate ones. ☐

2. The Calciner Plant in Northern Ontario has had issues with a Bucket Elevator (BE). The Bucket Elevator's main function is to deliver a product in the form of powder from one level up to the level above by buckets that are attached to a belt, which rotates around the top and bottom shafts, discharging powder from the buckets into the chute at the top of the BE. It has limited production rates to 4 t/h. Increasing feed rate would rapidly increase driver motor power consumption and its subsequent trip on high current draw. How can this be solved?

    A. Modify the shape of the buckets, the shape of the discharge chute and the way the product is being loaded into the buckets. ☐

    B. Analyze the relationship between speed and centrifugal force. ☐

    C. Increase the speed of the buckets. ☐

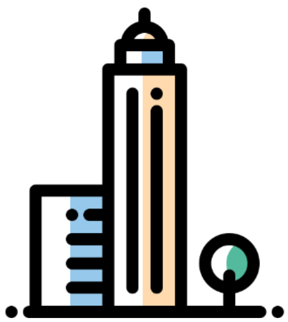


Source: https://www.ennomotive.com/basic-engineering-principles/

Handout 4

Instructions:

I. Read the following case and analyze the issue it presents. In small groups, discuss what you think would be a good proposal to address the problem.

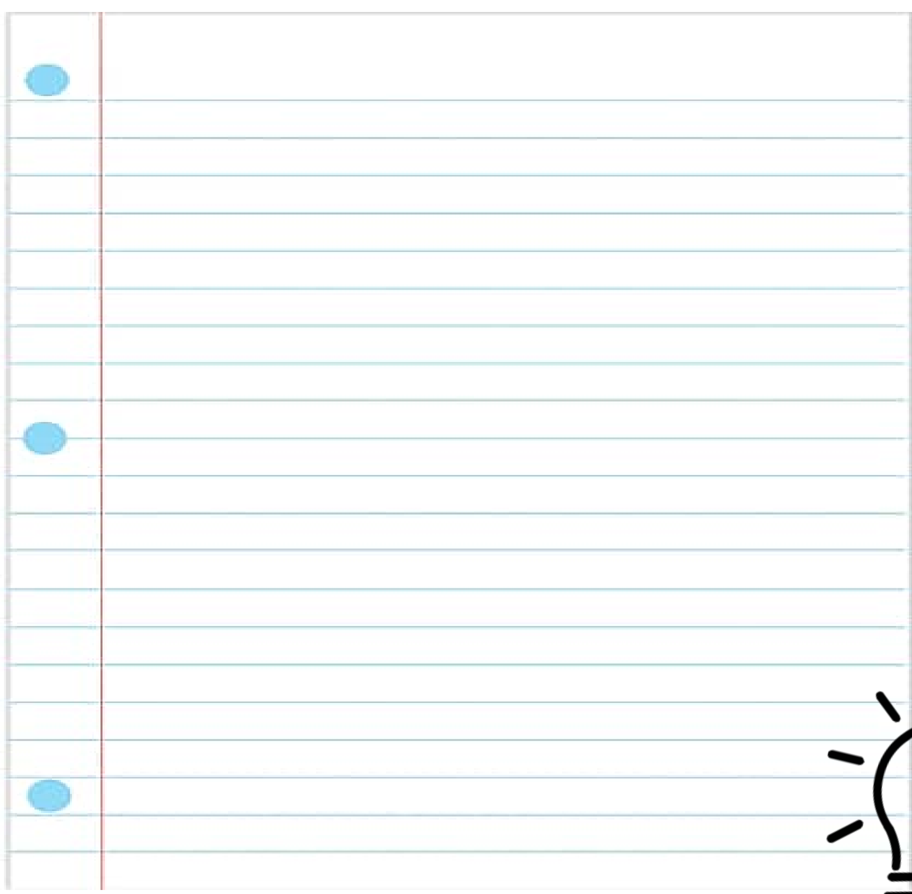


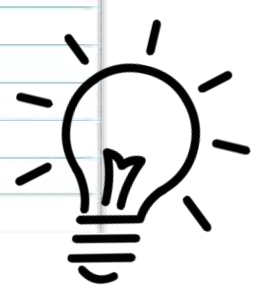
The maintenance of tall buildings is **a big part of the general cost**, including window-cleaning. At present, they are equipped with a BMU (Building Maintenance Unit) cradle system with two hanging jibs and **a suspended platform** attached to it to clean the windows. On average, with the cleaning techniques that involve workers, the windows of a 12-story building can be cleaned in 2 weeks and, also on average, this task is carried out 4 times every year.

So, think of a proposal for a system that uses the currently-installed hanging jibs so the window-cleaning can be done automatically or semi-automatically in buildings taller than 20m.

Source: https://www.ennomotive.com/basic-engineering-principles/

II. Organize your ideas on the space provided below. Use **key words** only**.**





Speaking aid: Useful Expressions

Use the following expressions for the different speech acts. You can add any other of your own.

Purposes	Language
Stating an opinion	-In my opinion... -The way I see it... -If you want my honest opinion.... -According to _____... -As far as I'm concerned... -If you ask me...
Asking for an opinion	-What's your idea? -What are your thoughts on all of this? -Do you have anything to say/add about this? -What do you think? -Do you agree? -Wouldn't you say?
Expressing agreement	-I agree with you 100 percent. -I couldn't agree with you more. -That is true. / That is for sure. -You are absolutely right. / Absolutely. / Exactly. -I'm afraid I agree with ___ -No doubt about it. **-(weak)** I suppose so. / I guess so. -You have a point there.
Expressing disagreement	-I don't think so. -**(strong)** No way. -I'm afraid I disagree. -**(strong)** I totally disagree. -I beg to differ. -**(strong)** I'd say the exact opposite. -Not necessarily. -That's not always true. -That's not always the case. -No, I'm not so sure about that.
Interrupting	-Can I add something here? -Is it okay if I interrupt for a second? -If I might add something... -I am sorry to interrupt, but... - **(after accidentally interrupting someone)** Sorry, go ahead. **OR** Sorry, you were saying... **- (after being interrupted)** You didn't let me finish.

Date: November 4th, 2019.
Teacher in charge: Garyan Rojas.
Assistant: Laura Coto. Lesson plan # 12.

Unit: 3 Exchanging Ideas

1. **Unit Goal:** By the end of the unit, students will be able to appropriately exchange ideas about project design with experts, colleagues and superiors by actively listening, asking questions, and reporting information orally.
2. **General Objective:** Accurately explain a future project design to clients, superiors and colleagues by organizing the ideas, including details and the necessary technical vocabulary.

Specific objectives: By the end of the lesson, students will be able to:

1. Appropriately use the first conditional by participating in a group collaboration activity.
2. Correctly order the stages of project design by completing their names.
3. Accurately identify the needs and specifications of a problem by analyzing case studies.
4. Accurately create a project design proposal by considering the needs and specifications of a particular case.
5. Correctly identify the implementation of effective presentation skills by watching a video.
6. Accurately examine their strengths and areas of improvement in oral presentations by participating in a peer feedback activity.
7. Appropriately explain detailed information of a project design proposal by delivering an oral presentation to a pretend audience of colleagues and superiors.
8. Accurately use simple future in active and passive voice by completing sentences in a grammar exercise.

Obj.	Procedures	Language	Strategies	Macro Skills	Time allotted
1	**Warm-up:** Sts work on the “conditional chain” activity in order to review the grammar from last class. Sts are divided into two groups and are given a color ball to pass around. They will have 10 seconds to add a sentence to the chain so that at the end all ideas are	**Key Language for task** Project design vocabulary and stages First conditional	Using linguistic cues	S L	15 min

	connected. Prompts will be related to specific steps of project design.				
2	**Schema activation:** Sts are asked if they remember the main five stages of project design. They stand up and go to the board to complete the missing letter in each of the names of the stages (initiating, planning, executing, monitoring & control, and closing). Then, as a whole class, they will arrange the papers in the correct order to complete the process and review the steps of the planning stage (needs, specifications, conceptual design, design embodiment, etc.).	**Key Language for task** Project design vocabulary and stages **Useful language** It seems to me that this stage is… I totally agree. / I disagree. If I'm not mistaken, the order is…	Associating concepts Ordering	R W S	10 min
3	**Pre-task 1:** In pairs, sts are told to go back to the three case studies used in the last session. They will fill out a form (handout # 1) in which they list the needs and (possible) specifications the client would ask for. Then, sts stand up and make groups with representatives of the previous pairs to share their ideas.	**Key Language for task** Words related to technical processes: *conveyor, ball bearings, bucket elevator, belt, top/bottom shaft, discharge, chute, cradle, jibs, story.* Words related to needs and specifications: *maintenance, costs, production time, out of service, production rates, motor power consumption*. **Useful language** The main need in this case is… One of the specifications will be…	Reasoning deductively	R S L W	15 min

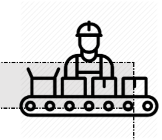
		Here, the client will expect the product/problem to...			
4	**Pre-task 2:** Sts go back to their original pairs and sit down. They choose one of the cases and define what their project design proposal will be by taking into account the needs and specifications listed before. Sts work on the conceptual design and the design embodiment (product architecture) in a piece of newsprint paper considering that they will be presenting the information orally.	**Key Language for task** Words related to technical processes. Words related to needs and specifications. Simple future in active and passive voice **Useful language** Based on the need of___(ing), we will… "X" will be needed to address the issue of… In order to… we will…	Negotiating Analyzing steps	S L W	30
5	**Pre-task 3:** Once the design is ready, students are told that they have to prepare to present their ideas. They will identify presentation skills by watching an excerpt of a video and using handout 2 to mark the strategies that were used by the speaker. Ideas are shared as a whole class in his delivery. Video: https://www.youtube.com/watch?v=qdLWAHFaPj8 [Joachim Horn: A solution for building a generation of inventors]	**Key Language for task** Presentation skills vocabulary. Words related to technical processes. Words related to needs and specifications. **Useful language** The presenter seemed to be careful with… In the future, it will be good for the presenter to…	Analyzing expressions	R L S	10 min

6	**Pre-task 4** In the same pairs, sts take 5 minutes to rehearse how they would go about their project design presentation on the case study they chose before. Each student will be given an adaptation of the rubric that will be used in their final course presentations and the previous checklist to provide each other with feedback before actually presenting in front of the class (handout 3). Sts are provided with prompts they can use as they give feedback to their peer.	**Key Language for task** Words related to technical processes. Words related to needs and specifications. Presentation skills vocabulary. **Useful language** I think that for the oral presentation you should… It will be better if you… Try to pay attention to… I agree. Next time I will… Next time I won't…	Functional planning	S L	15 min
7	**Task**: Explaining detailed information about the project proposal to others in a meeting. -Sts deliver the oral presentation they prepared for in the previous activities. T and peers will pretend to be their superiors and colleagues. Planning: sts analyze their previous peer assessment as a way to reflect as a team before presenting their project proposals to the class. Reporting. After listening to all the presentations, class is divided into two big groups and sts share their general perceptions on how the presentations were delivered by taking into account the tips presented before.	**Key Language for task** Words related to technical processes. Words related to needs and specifications. Presentation skills vocabulary Simple future in active and passive voice **Useful language** One strength I was able to see was…	Getting someone's attention. Self-monitoring Auditory representation	S L	35 min

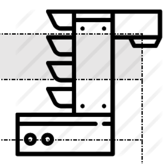
		Something we will need to improve is…because…			
8	**Post-task:** Language focus: Sts go back to the language they used when negotiating what the product would be like and also to the language they used while working on their performance reflection. T asks sts to identify the verb tense that was mainly used. Analysis: T goes over the form, meaning and use of simple future in both active and passive voice. Then, T shows a brief script of what was said in the video and addresses the correct way to read it by marking the thought groups. Practice: -Sts work on handout 4 where they have to complete the blanks with simple future either in active or passive voice. Answers are checked as a whole class. -Sts make new pairs and practice reading the sentences in the previous exercise by appropriately identifying the thought groups.	**Key Language for task** Simple future in active and passive voice **Useful language** I think we should use passive/active voice because… I agree/disagree because...	Using linguistic cues	R S L	20 min

Handout 1

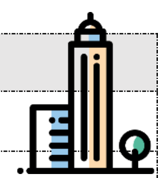
Instructions: Go back to the case studies in your portfolio (lesson 11, handout # 3 & 4) and write down the needs presented and the specifications a client would ask for. **Use key words only.**



Case study # 1: conveyor system	
Needs:	**Specifications:**



Case study # 2: bucket elevator	
Needs:	**Specifications:**



Case study # 3: window cleaning system	
Needs:	**Specifications:**

Handout 2

Oral Presentations Aid

Instructions: Use the oral presentation aid and use it as a checklist as you watch the video. Which of these recommendations does the speaker use? Put a (√) or an (x) in the space provided.

√= Present

x= Not present

The speaker…	√ / x
1. Appears confident at all times and avoids apologizing.	
2. Keeps a formal, upright posture.	
3. Makes eye contact with the audience.	
4. Uses gestures when necessary to add emphasis or to help describe something.	
5. Uses a tone of voice that is loud enough for the audience to hear clearly.	
6. Makes sure that the speed of the delivery is easy to follow and makes changes in pace when necessary.	
7. Appropriately adjusts the pitch of the voice when asking questions.	
8. Tries to convey enthusiasm and energy through the voice.	
9. Delivers a speech that is organized with a clear introduction, body, and conclusion.	
10. Uses visuals that are appealing and that are not overloaded with text.	

Source: Delivering an Effective Presentation, University of Leicester. https://www2.le.ac.uk/offices/ld/resources/presentations/delivering-presentation

Handout 3

Peer Assessment

Instructions: Use the rubrics below as you rehearse the presentation with your peer. Once ready, go over the feedback together and reflect on it before presenting in front of the class.

Rubric 1

√= Present / x= Not present

The speaker…	√ / x
1. Appears confident at all times and avoids apologizing.	
2. Keeps a formal, upright posture.	
3. Makes eye contact with the audience.	
4. Uses gestures when necessary to add emphasis or to help describe something.	
5. Uses a tone of voice that is loud enough for the audience to hear clearly.	
6. Makes sure that the speed of the delivery is easy to follow and makes changes in pace when necessary.	
7. Appropriately adjusts the pitch of the voice when asking questions.	
8. Tries to convey enthusiasm and energy through the voice.	
9. Delivers a speech that is organized with a clear introduction, body, and conclusion.	
10. Uses visuals that are appealing and that are not overloaded with text.	

Source: Delivering an Effective Presentation, University of Leicester. https://www2.le.ac.uk/offices/ld/resources/presentations/delivering-presentation

Rubric 2

Score / **Category**	**3**	**2**	**1**
Grammar: your peer includes variety of grammar structures and makes a correct use of them.			
Vocabulary: your peer uses vocabulary related to machine parts, tools, and new technologies as well as sequencers and linking words.			
Content: descriptions are clear and detailed for the project.			
Pronunciation & intonation: pronunciation is clear and allows the listener to understand the message.			
Fluency: speech is natural and the are almost no breakdowns in communication.			

3= meets expectations
2= approaches expectations
1=needs more work to approach expectations

Handout 4

Instructions: Complete the blanks by using simple future. Decide if active or passive voice is necessary.

1. Mechanical engineering _____________ (help) with robots like ASIMO by facilitating the functioning of the limbs and other body parts.
2. Millions of dollars _____________ (invest) by Procter & Gamble for the execution of the project.
3. Independent mechanical engineers _____________ (band) together to work on a project through an Internet site.
4. The device _____________ (have) applications beyond engineering.
5. John _____________ (ask) to deliver his project proposal presentation next month.
6. This device _____________ (develop) in order to replace the traditional mouse and keyboard with more natural, human-centric tools.
7. Model-based and self-learning controls _____________ (be) important for more robust and optimal calibration as well as for accelerating the calibration process.

Answer Key

1. Mechanical engineering **will help** with robots like ASIMO by facilitating the functioning of the limbs and other body parts.
2. Millions of dollars **will be invested** by Procter & Gamble for the execution of the project.
3. Independent mechanical engineers **will band** together to work on a project through an Internet site.
4. The device **will have** applications beyond engineering.
5. John **will be asked** to deliver his project proposal presentation next month.
6. This device **will be developed** in order to replace the traditional mouse and keyboard with more natural, human-centric tools.
7. Model-based and self-learning controls **will be** important for more robust and optimal calibration as well as for accelerating the calibration process.

Appendix GG. Glossary # 1

Word	Definition
Nouns: objects, processes	
Apparatus	the equipment, such as tools and machines, which is used to do a particular job or activity.
Axle	a bar connecting two opposite wheels, as of an automobile
Convection	the process by which the very small parts in a liquid or gas move and give out heat
Coupling	an object used for joining two things together
Device	an object or machine that has been invented for a particular purpose.
Excitation	the act of making something vibrate
Fin	a plate or other object which is attached to a surface in order to improve the flow of heat
Fuel	a substance that is used to provide heat or power, usually by being burned
Handle	a part of an object designed for holding, moving, or carrying the object easily
Idler	a gear used between a driver and a follower to maintain the direction of rotation.
Motion	the act or process of moving, or a particular movement.
Motor	a device that changes electricity or fuel into movement and makes a machine work
Pipe	a tube through which liquids or gases can flow
Piston	a short, solid piece of metal that moves up and down inside a cylinder in an engine to press the fuel into a small space and to send the power produced by it to the wheels
Pump	a machine or device that is used to force a liquid or gas to flow in a particular direction
Radiator	a cooling device of tubes and fins, as in an automobile, through which circulating coolant passes
Shaft	a metal bar in an engine that causes a part to move when another part moves
Thermostat	a device that switches a system or motor on or off according to the temperature
Valve	a device attached to a pipe or a tube which controls the flow of air or liquid through the pipe or tube.
Wire	flexible metallic conductor, especially one made of copper, usually insulated, and used to carry electric current in a circuit.

What is the correct pronunciation of….? How do you pronounce….?

Apparatus

Convection

Excitation

Motor

Piston

Radiator

Thermostat

Valve

Verbs: actions	
To assemble	to come together in a single place or bring parts together in a single group
To augment	to increase the size or value of something by adding something to it
To burnish	to make or become shiny or smooth by friction; polish
To perform	to do an action or piece of work

What is the correct pronunciation of….? How do you pronounce….?

augment

Adjectives (characteristics, descriptive words)	
Pneumatic	operated by air pressure, or containing air

What is the correct pronunciation of….? How do you pronounce….?

pneumatic

Sources:

https://dictionary.cambridge.org/us/

https://www.collinsdictionary.com/

https://www.macmillandictionary.com/

Appendix HH. Glossary # 2

VERBS (actions)	
Word /phrase	***Definition***
bridge (a gap)	to make the difference between two things smaller
design	to make or draw plans for something
drop	to fall intentionally or unintentionally, or to let something fall
embed	inserting and forcing things into other things
enable	to make someone able to do something, or to make something possible:
ensure	to make something certain to happen:
examine	to look at a person or thing carefully and in detail in order to discover something
gather	to collect or obtain things, esp. from different places
input	to put information into a computer or other piece of electronic equipment
manufacture	to produce goods in large numbers, esp. in a factory using machines
overcome	to defeat or succeed in controlling or dealing with something
require	to need something, or to make something necessary
seek	to search for something or try to find or obtain something
shrink	to become smaller or cause something to become smaller
slot	to put something in a particular position
spark	to cause the start of something
wear out	to make someone extremely tired
yield	to supply or produce something positive such as a profit

What is the correct pronunciation of….? How do you pronounce….?

Accelerate

Interconnect

Nouns (objects, processes)	
Word / Phrase	***Definition***
automation	the use of machines that operate automatically
beam	a line of light coming from the sun or a bright light
bitcoins	a digital currency produced by a public network
breakthrough	an important discovery or development that helps to solve a problem
catalytic converter	a device on an engine that reduces the amount of poisonous gas that is released from the exhaust
clearance effect	a small amount of high-pressure air is trapped in the clearance when the discharge valve closes in the end of the compression cycle
clearance	the space between the top of the piston and the cylinder head of an air compressor
crack	a thin line or space in the surface of something, usually a sign of damage
diagnosis	a judgment about what a particular problem is, made after examining it
feature	a typical quality or an important characteristic of something
feedstock	material that is used in an industrial process
flaw	a fault, mistake, or weakness that causes something not to be perfect
gradient	an increase or decrease in the magnitude of a property (e.g. temperature, pressure, or concentration) observed in passing from one point or moment to another
hardware	metal objects, materials, and equipment, such as tools
hinge	a folding device, usually made of metal, that is attached to a door, gate, or lidon one side, allowing it to open and close
hurdle	a difficulty to be dealt with
inkjet print	an electronic printer that blows ink onto paper using very small jets
insights	understanding of a complicated problem or situation
iteration	the process of doing something again and again, usually to improve it
layer	a thin sheet of a substance on top of a surface

lens	a piece of glass or plastic having a curved surface that changes images (usually to make them larger, smaller, or clearer)
maintenance	the work needed to keep something in good condition
management	the control and organization of something
modularity	the extent to which a software/Web application may be divided into smaller modules
nozzle	a narrow piece attached to the end of a tube so that the liquid or air that comes out can be directed in a particular way
path	a line along which something moves
powder	a loose, dry substance of extremely small pieces
revenue	the income that a business or government receives regularly
signal	an action, movement, or sound that gives information, a message, a warning, or an order
transmission	the act of sending or giving something
wavelength	the distance between two waves of energy
width	the distance across something from one side to the other

What is the correct pronunciation of…..? / How do you pronounce…..?

Battery
Combustion
Generator
Temperature
Turbine

Additive
Anomalies
Laser
Protocol
Vehicle

Barrier
Equipment
Platform
Sphere

Adjectives (characteristics, descriptive words)	
Word / Phrase	***Definition***
fine	very thin or in very small grains or drops
groundbreaking	original and important; showing a new way of doing or thinking about things
intricate	having a lot of small parts or pieces arranged in a complicated way, and therefore sometimes difficult to understand in detail
movable	able to be moved
precise	exact and accurate in form, time, detail, or description
reliable	deserving trust; dependable
secure	free from risk and danger
several	more than two and fewer than many
smooth	having a surface or substance that is perfectly regular and has no holes or lumps
wavy	curving in shape

What is the correct pronunciation of…..? / How do you pronounce…..?

Mobile
Immediate
Common
Modular

Susceptible
Vulnerable
Accessible
Multiple

Inherente
Autonomous
Radial
Volatile

Sources:
https://dictionary.cambridge.org/us/
https://www.collinsdictionary.com/
https://www.macmillandictionary.com/

Appendix II. Glossary # 3

VERBS (actions)	
Word /phrase	**Definition**
customize	to make or change something according to the buyer's or user's needs
quote	to state a price or amount that something will cost
supply	to provide something that is needed or wanted
turn out	to come, appear, or be present

Nouns (objects, processes)	
Word / Phrase	**Definition**
adhesive	glue (it can also be ad adjective: covered with glue, sticky)
expense	an amount of money needed or used to do or buy something
hose	a long, usually plastic or rubber pipe used to move water or other substances
hub	the central or main part of something where there is most activity
label	a piece of paper or other material that gives information about the object it is attached to
needle	a thin, solid, metal piece with a sharp point at one end
output signal	an amount of signal that a machine produces
overview	a short description of something that provides general information but no details
quotation	the price that a person says they will charge
range	the level to which something is limited, or the area within which something operates
receipt	a piece of paper which proves that money or goods have been received
screw	metal fastener
sheath	a close-fitting covering to protect something
subsidiary	a company that is owned by a larger company
supplier	a person, company, or country that provides goods of a particular kind

Adjectives (characteristics, descriptive words)	
Word / Phrase	**Definition**
cost-effective	providing good value for the amount paid
custom (software)	made for a particular person to buy
leading	first or most important
likely	expected to happen; probable
risky	involving the possibility of something bad happening
wide	far from side to side

Sources:
https://dictionary.cambridge.org/us/
https://www.collinsdictionary.com/
https://www.macmillandictionary.com/

Appendix JJ. Glossary # 4

VERBS (actions)	
Word /phrase	**Definition**
actuate	to make a machine work
aim	to point or direct a weapon or other object toward someone or something
fire	to operate a machine or tool by discharging something from it
release	to stop holding, to allow to move or fall
swivels	to turn around a central point in order to face in another direction. To cause to turn or rotate
synchronize	to (cause to) happen at the same time
reclaim	to treat waste materials in order to get useful materials

Adjectives (characteristics, descriptive words)	
Word / Phrase	**Definition**
Serrated	having a row of sharp points along the edge
Synchronous	happening or done at the same time or speed:
Empty	having nothing inside

Nouns (objects, processes)	
Word / Phrase	**Definition**
winding	one or more turns of wire that forms a continuous coil through which an electric current can pass, as used in transformers and generators.
roller	a cylinder that turns around in a machine or device.
reel	a round or cylindrical device on which a rope, wire, film, or other long, thin strip or object is rolled
torsion	twisting effect on something such as a piece of metal. The force that causes twisting
spring	a spiral of wire that returns to its original shape after it is pressed or pulled.
indexing	a system that measures the present value of something when compared to its previous value or a fixed standard
turret	a block holding several cutting tools, which may be rotated to present any of the tools to the work. structure with tools projecting radially that can be indexed round to select or to bring each tool to bear on the work
core	the most important part of something
triggering	a device that make something start
impurity	substances that are present in small quantities in another substance and make it dirty or of an unacceptable quality.
web	The web of an I-beam or H-beam is the central section that joins the two flanges.
flange	A part that sticks out from an object in order to keep the object in position, strengthen it, or attach it to another object.
chuck	a device that holds a workpiece in a lathe or a tool in a drill. It has two jaws that move together to keep the workpiece or tool in a central position.
lathe	a machine which is used for shaping wood or metal.
chain	metal rings connected together in a line.
belt	circular strip of rubber that is used to drive moving parts in a vehicle.

Sources:
https://dictionary.cambridge.org/us/
https://www.collinsdictionary.com/

https://www.macmillandictionary.com/

Appendix KK. Glossary # 5

VERBS (actions)	
Word /phrase	**Definition**
hypothesize	to suggest a possible explanation for something based on the information you have, but without knowing whether the explanation is really true
mount	to hang or put up on a stand, support
plot	To mark certain points on a graph and then join the points up.
dislodge	to force someone or something from a place or position

Adjectives (characteristics, descriptive words)	
Word / Phrase	**Definition**
attainable	possible to achieve
austenite (Derived word: austenitic)	A solid solution of carbon in face-centered-cubic gamma iron, usually existing above 723°C. The gamma phase of iron, stabilized at low temperatures by the addition of such elements as nickel
dislodged	Removed by force from a fixed position
flat	smooth and level, with no lumps or curves
linearized	made or represented as linear
rough	uneven and not smooth.
thin	An object that has a short distance between two opposite sides, edges, or surfaces

Nouns (objects, processes)	
Word / Phrase	**Definition**
assay	a chemical test to establish what a substance contains
compliance	the practice of obeying a law, rule, or request
deflection	the amount by which something moves from its original position
depth	the distance from the top of something to the bottom
ease	to become less bad, or to make something become less bad
flux	a condition of continuous change
ftom	Fraunhofer thermal object model
hardenability	how easily a metal can be hardened when cooled rapidly from a high temperature.
inlet	a tube, valve, or other part through which a fluid enters a device or machine.
insulation	suitable non-conductive material enclosing, surrounding, or supporting a conductor. It is put on or around a container or pipe to stop heat from being lost.
joint	the place where two things are fastened or fixed together.
length	amount that it measures from one end to the other along the longest side.
lift	a movement in which something is moved to a higher position
mass flow	the movement of fluids down a pressure or temperature gradient
outlet	a point in a wiring system from which current can be taken to supply electrical devices.
quenching	the process of removing or reducing a physical property such as heat or light, for example hardening steel by rapidly cooling it.
rate	the number of times something happens, or the number of examples of something within a particular period of time
rig	a large structure that is used for removing oil or gas from the ground or the bottom of the sea
rotameter	a device which uses a moving float to measure how fast a fluid is flowing.
saw	a tool with a sharp edge that you use to cut wood or other hard material
scale	the size or level of something
shield	Something that protects

slides	is a piece of glass on which you put something that you want to examine through a microscope.
thermal lag	the delay of heat transmitted through a wall. A measurement of the ability of walling material to slowly absorb and release heat energy.
thermocouples	a device made from two metal wires, which is used to measure temperature.
toughness	the ability of a metal to withstand repeated twisting and bending, measured by the energy in kilojoules needed to break it
trade off	a situation where you exchange all or part of one thing for another.
wavelength	the distance between a part of a wave of energy such as light or sound and the next similar part.
wax	any of various viscous or solid materials of natural origin:
welding	the process of joining two plastic or metal parts by melting them

Sources:
https://dictionary.cambridge.org/us/
https://www.collinsdictionary.com/
https://www.macmillandictionary.com/

Appendix LL. Glossary # 6

VERBS (actions)	
Word /phrase	**Definition**
waste	to use too much of something or use something badly
dim	to become less bright, or to make something become less bright
wonder	to want to know something or to try to understand the reason for something
deliver	to carry to and leave at the proper place or places; distribute
discharge	the release of the electric charge stored in a capacitor through an external circuit. to release or remove

Adjectives (characteristics, descriptive words)	
Word / Phrase	**Definition**
bright	radiating or reflecting light
hanging	attached to something overhead and not supported from below; suspended;
suspended	hanging by a support from above so as to allow free movement
attached	joined or fixed to something
suitable	appropriate; proper; fit
subsequent	happening after something else
centrifugal	moving away from the point around which it is turning

Nouns (objects, processes)	
Word / Phrase	**Definition**
innovation	a new idea, method, or device.
interface	a device or program enabling a user to communicate with a computer
applications	a program that performs a particular task or set of tasks
behavior	the way in which something functions or operates
smart system	the incorporation of functions of sensing, actuation, and control in order to analyze a situation and make decisions based on the available data in a predictive or adaptive manner
cradle system	a frame which supports or protects something. a piece of equipment for standing on while moving up and down the outside of a tall building, for example in order to clean windows
jibs	the projecting arm of a crane
average	the numerical result obtained by dividing the sum of two or more quantities by the number of quantities
conveyor	a mechanical contrivance, as a continuous chain or belt
ball bearings	a bearing containing hard steel balls.
bearing	a bearing is a device that supports moving parts and allows them to move more smoothly by reducing friction.
buckets	round metal or plastic container with a handle attached to its sides.
belt	a circular strip of rubber that is used to drive moving parts
shaft	a revolving rod that transmits motion or power.
rod	a long circular bar of raw material.
chute	an inclined or vertical passage down which something may be slid or dropped
prototype	the first or original model from which others are copied.

Sources:

https://dictionary.cambridge.org/us/

https://www.collinsdictionary.com/

https://www.macmillandictionary.com/