Institutional Strategy

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I. INTRODUCTION

Active Learning (AL) is an approach to instruction that involves actively engaging students with the course material through discussions, problem solving, case studies, role plays and other methods (Queens University, 2018). Active learning approaches place a greater degree of responsibility on the learner than passive approaches such as lectures, but instructor guidance is still crucial in the active learning classroom. Active learning activities may range in length from a couple of minutes to whole class sessions or may take place over multiple class sessions.

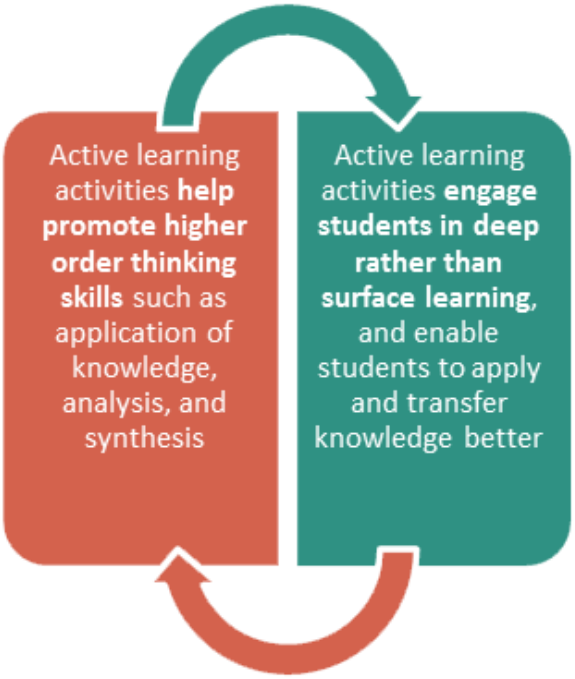

Figure 1: What is Active Learning (Queens University, 2018)

The ALIEN (Active Learning in Engineering Education) research project aims to design, implement, and validate an active learning-based learning methodology based on science, technology, engineering, and mathematics (STEM). The methodology will be supported by a virtual learning environment that includes a set of digital tools and will allow students to experiment, collaborate, and communicate with an extensive and multinational learning community that includes other stakeholders such as teachers and researchers. In fact, ALIEN's expected impact includes the institutional strategical adoption of active learning as the primary pedagogical approach to education.

This document guides the definition of such strategical approach addressing three different levels:

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- The institutional level with the goal of getting AL and PBL as a strategic and systematic option
- The pedagogical level with the goal of having teachers and students adopting AL and PBL
- The technological level, by demonstrating through innovative ICT tools, how to support AL and PBL

The strategic plan to be adopted/adapted by each institution on the use of Active Learning and Problem/Project Based Learning will have mostly impact on the institutional and pedagogical level. As part of the institutional strategy, the PBL laboratory impacts directly on teachers and students but depends heavily on the technological level. The validated pedagogical methodology (flexible enough to allow for several instances) that promotes AL and PBL impacts mainly at pedagogical level but depends on the technological tools. Its systematization depends on the institutional level.

Through the ALIEN approach…

- Teachers from Higher Education in Engineering/Sciences/Technical faculties will be able to apply the Active Learning methodology and the tools to be developed in the project;
- The students will benefit from a more motivating pedagogical context and will be more attracted to these subject areas;
- HEIs will benefit from adopting a more active pedagogical approach and will be able to attract more students, will establish closer links with the society and the labour market.

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II. ACTIVE LEARNING

Active learning is generally defined as an instructional method that requires interaction with students to do meaningful learning activities or thinking about what they are doing in the classroom. The core element of the method is students' engagement throughout the learning process (Bonwell and Eison, 1991). Unlike passive learning, this learning approach is said to be better because it involves students' interaction among themselves as well as the teacher through discussions and collaborations, critical thinking, problem solving and connecting new learning in the students' world (OpenLearning, 2018). There is a lot of methods that apply active learning techniques in the teaching such as think pair share, role playing, discovering plate boundaries, peer review, and game based learning (Gallery Walks, 2018). When it comes to learning a new concept or skill, instruction is essential but practice makes perfect (Panopto, 2018). Traditionally, lectures teach students new concepts and active learning helps students master them. Active learning works because it engages students in the learning process. More specifically, active learning in the classroom has distinct advantages:

- Teachers and students get more one-on-one interaction — students receive frequent and immediate feedback from instructors during active learning activities
- Students learn through collaboration and interaction with other students, engaging more deeply with the course content and building invaluable social skills
- Teaching is more inclusive — students with different learning styles get a personalized experience

"The ultimate contribution of active learning is an innovative way of thinking, where reality and truth are not a case of black and white, where teaching and learning are an exploratory journey to the wealth of knowledge and different realities, and, finally, where nothing is taken for granted but the provision of a fruitful learning context, full of interactions, that can reveal to everyone his or her own path to inner achievement and fulfilment." (Misseyanni, et al., 2018, p. xviii)

In other words, active and experiential learning methodologies motivate and engage learners that are technologically-savvy, rapidly absorb pieces of information and expect instant responses and feedback (Batista & Vaz de Carvalho, 2008).

Engineering is one of the fastest changing fields that can benefit from AL, once permanent innovation is mandatory, and professionals should combine the more technical aspects of their knowledge with Science and Technology, providing a problem-solving posture that beneficiates society: "So, at present, engineers with technical skills must also learn how to work in interdisciplinary teams, how to develop designs rapidly, how to manufacture sustainably, how to combine art and engineering and how to address global markets." (Ciampi, et al., 2016, p. 2)

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Guidelines for Engineering Education offer insight in common goals and perspectives on how to best address the challenges, suggesting the adoption of alternative learning methods, such as student-cantered learning and a strong connection between theory and practice, and the reinforcement of aspects that are key to a comprehensive professional practice (Colombo, et al., 2014).

PROBLEM AND PROJECT BASED LEARNING (PBL)

Traditional learning methodologies based on passive dissemination of information fail to effectively develop the broad skills required today in industry. Emerging learning methodologies, such as Project and Problem-Based Learning (PBL), offer significant benefits by contributing to the development of sophisticated skills such as analysis, synthesis, and evaluation. Problem-based learning is an active methodology focusing on the learner. Within this framework, students develop knowledge and skills following a process of synthesis of solutions to problems that are usually based on real situations. The method offers significant benefits including the development of critical thinking, creativity, the capacity for collaboration, communication skills, inherent motivation to engage in learning, and business thinking. Problem based learning (PBL) can also be regarded as a form of active learning. It is based on the fact that in order to solve problems, the students must be able to utilise their existing body of knowledge and if they do not have it, they need to proactively searching for it, inside or outside the classroom. PBL has gained world-wide interest as an innovative technique that engage learners for deep learning, and develop a multitude of crucial professional skills, especially self-directed learning and problem solving (Strobel, 2007), which are essential in graduates for the 21st Century (Duderstadt, 2010). Student-centred learning and collaborative learning are among the basic characteristics of problem-based learning (PBL). Student-centred learning assumes the idea that student can “learn by doing” and therefore acknowledges that they can play an active role in their learning as problem-solvers and think in critical and creative ways (Barron et al., 1998). Teamwork among the students engaged in collaborative learning increases the chances of success and enables the development of communication and interpersonal relationship skills.

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Figure 2: Active Learning Methodologies (Queens University, 2018)

Project-Based Learning appears to be effective model for producing gains in the development of social skills. It offers a wide range of benefits to students. Some of these benefits can be listed as below:

a) Grouping students of all academic levels, mixing the males and females, the athletes, the popular, and the socially awkward, breaks down the social structure of “cliques” often found within schools and leads to higher self-esteem and better communication skills.

b) Students, working both individually and cooperatively, feel empowered when they apply critical thinking to solve problems. In this productive work, students learn and strengthen their work habits and throughout this process, students learn new knowledge, social skills and positive.

c) Student activity revolves around a complex series of interactions (between team members) and draws on a range of key transferable skills such as communication, planning and team working.

Moreover, the teacher’s role is less that of an instructor who transmits information and organizes activities for practice and more that of a guide and a facilitator (actually it is a critical role). Projects require that teachers know their learners’ interests. Teachers must listen when learners become excited about a topic, and start asking questions. Facilitating project-based learning requires the kind of leadership skills that allow teachers to help a group of learners to move in the direction that they want to go, without getting defensive when students decide they like their own ideas better. It is of great importance if teachers possess a tolerance for ambiguity, some skills in helping learners negotiate conflicts and enough self-confidence not to give up when a project peters out or refuses to come together.

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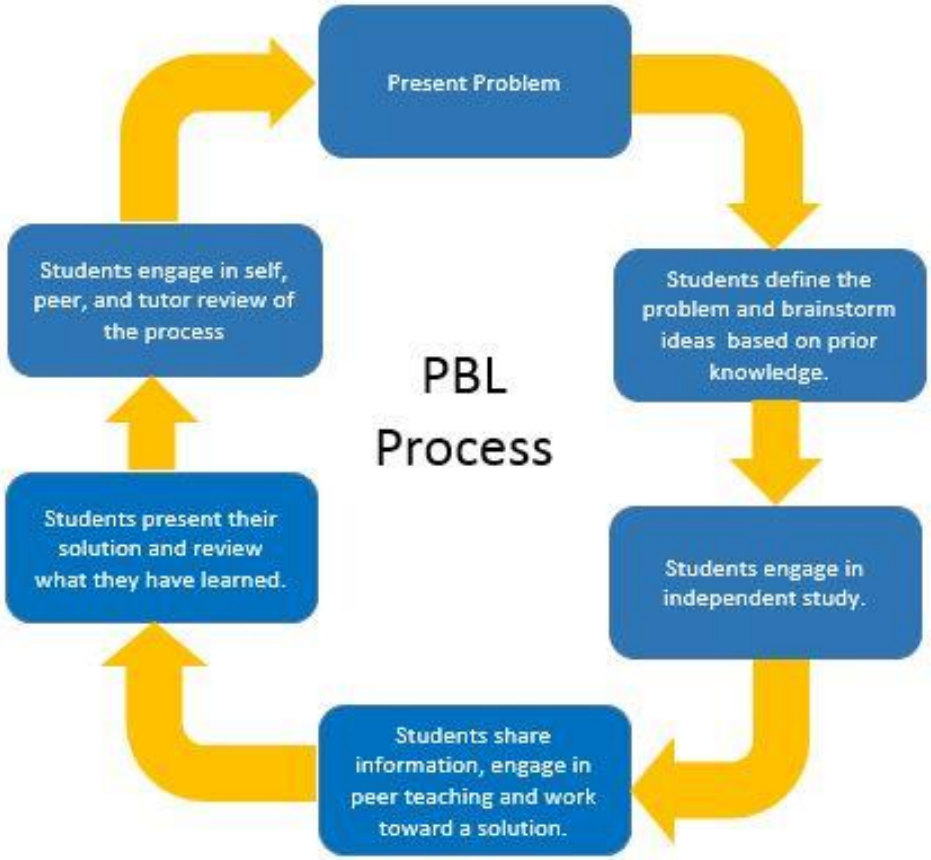

Figure 3: PBL Process (Gukeisen, 2013)

Problem-Based Learning is a teaching method where complex real-world problems are used to promote the development of critical thinking skills, problem-soling abilities and communication skills (Tsalapatas, 2018). During the past few years Problem-Based Learning had played an important role in university curricula. Teachers use technology in class in many forms (videos, Internet, TV and other educational tools) and students learn to research the Internet, collect information and compile it into projects while working in groups.

Teachers, in order to make their class attendance more attractive, need to attend continuous training programs to update cognitive backgrounds and skills against the traditional methods of teaching. Of course, an important element for all this to be efficient is the existence of material and technical facilities. The continuous combination with teaching, alternative teaching methods, knowledge of each subject and motivation are important factors for the development of professional competencies of adult educators. Given the fact that laboratory personnel comes from formal education - and therefore tends to carry every stereotyped and conventional teaching trends in university classes, the need of the training support for teachers, young and old gets bigger.

Undergraduate and postgraduate teachers should be encouraged by their Administration to join/participate in pedagogical nature facilities and incentives in conferences so they are

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informed for all alternative forms of education and integrate them into teaching. Finally, pedagogical courses should be held, with emphasis in the field of alternative teaching as it is now undeniable that they contribute to a better school performance for learners and especially adults.

WHY SHOULD WE USE PROBLEM-BASED LEARNING

Here are 12 reasons why teachers, guides, educators, educationists, or students should go for PBL

1. Scope of work

The first and foremost reason to go for problem-based learning is that it enables educators, teachers, and students to learn and adopt structures around projects rather than having lecture-based learning and reading-writing assignments of the traditional classed room learning. Students learn to comprehend the entire scope of the project and put the execution into a structure under guidance of their teachers or supervisors.

2. Real world problem simulation

Problem-based learning focuses on enabling student to face real world situations simulated in the forms of the projects. Students learn while doing what they know and develop new learning around hobbies, passions, and careers. They often develop new hobbies, passions, and liking for new careers.

3. Improves the interpersonal skills of a student

It greatly impacts the development of interpersonal skills of the students. Projects given often are more complex than in the assignments given in the traditional classroom-based learning. Students need to structure their efforts in organizing their survey required for the projects, analyze the survey results, and prepare reports to reach markets and collaborates with sponsors of the projects. In the entire approach or different stages of the project they improve their communication skills to collaborate with various stakeholders.

4. Concept and creativity development

Problem-based learning develops greater depth of understanding the concepts than in traditional classroom-based learning and results in improved levels of student's creativity. Real world situations given in the project are more capable to draw students' attention and capture their interest to provoke the needed level of thinking to apply new knowledge in a problem solving context.

5. Determines the actual knowledge

Project-based learning determines in depth knowledge and experience of the students and sometimes of teachers in comparison to the fixed length of learning experience of traditional

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classroom-based learning. In project-based learning student develop their skills and knowledge while classed-based learning has shorter span of memorizing based experience derived from a rote approach.

6. Choice of selecting real world problems

Another great reason to go for project-based learning is that projects are chosen by the students or assigned by the teachers according to the students' interest. Students are presented to have choice based on their interest in selecting a real world problem presented in the project. Interest-based selection of projects gives student unique ways of solving different problems which are diverse even in the same class, where as traditional classroom-based learning has question/answer-based essays and exam writing, including assignments given to all students of the class.

7. New style assessment of students' skills

Teachers are able to assess students' capabilities to observe, survey, and investigate, then allocate the projects determining the activities and events based on their interest. Students find themselves capable of honing their observation and analyzing skills. Teachers can directly assess the development of these skills among their students when they perform activities of the project work.

8. Visits to field-sites of Real world problems

A significant feature of problem-based learning is field-site visits by the students, teachers, and other involved researchers and educationists as needed in the project executions which open new ways of learning and collaborating with stakeholders and new people.

9. Direct demonstration of the capability

Teachers get greater opportunity to assess their students' capabilities demonstrated in the performing activities and events organized in the projects than the essays and exams of the traditional classroom learning based on rote learning and memorization to write what teachers have taught as their fixed and pre-determination of the topic or subject.

10. Technology inclusion

Problem-based learning is an effective way of including technology in the learning laboratories of the education system. Projects selected by students according to their interest are now likely to involve computers and the internet, as well as interactive whiteboards, GPS devices, and cameras.

11. Tracking of progress

In problem-based learning teachers and students both can track their activities involved in the project given to the student to solve real world problems. In traditional classroom-based learning this is ever missing, as not required or non-existing mechanism in the structure.

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12. End-To-End problem-solving Skills

In problem-based learning students undergo various stages of problem solving through structure of the project which include various stages like project scoping, work planning, activity performing and tracking, managing uncertainties presented during problem solving activities of the project, presentation of the project, and closure. Students have opportunities to develop skills of observation, survey, research, reporting, presentation, communication, and collaboration with people involved, team building, and leadership in the end-to-end problem solving approach of problem-based learning.

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III. INSTITUTIONAL APPROACH TO ACTIVE LEARNING

There is no special curriculum for Problem-Based Learning in higher education. Furthermore, there are no formal guidelines for teachers on how to apply such methods in the classroom. In addition, no training exists for teachers on hot to integrate AL and PBL, or other emerging pedagogies into educational activities for their students. As a result, teachers may sometimes be negative towards emerging educational methodologies, such as Problem-Based Learning in their instructional practices. Teachers bear the responsibility of integrating Problem-Based Learning into their classes through their own initiative if they so choose. It is not uncommon for teachers to design activities for their students or to research the internet for related educational content, however, when this takes place, it happens as a result of personal interest of the teachers to enrich learning activities for the benefit of their students.

Currently Problem-Based Learning in deployed in courses such as mathematics and natural sciences, including physics, chemistry, biology and geology. These courses traditionally apply Problem-Based Learning. Typically, students are challenged to solve exercises that are specific to the course being taught. For example, students are asked to solve math or science exercises that the teacher selects from the formal school text book. Students typically work on exercises at home, while the teacher also solves exercises on the blackboard.

The main issue with this approach is the fact that students only have the opportunity to apply Problem-Based Learning within the strict context of a specific course. They rarely get the opportunity to apply Problem-Based Learning in wider contexts that challenge them to integrate knowledge from different courses, e.g. to integrate physics, chemistry, and math knowledge towards resolving broader exercises, the solution to which requires knowledge from diverse fields.

Another challenge that teachers and students face is the limited infrastructure available in universities as well as the lack of formal teaching training in AL and PBL. Physical labs, either physics, chemistry, or computer labs, are limited and do not necessarily exist in all universities. As a result, Problem-Based Learning is limited to paper and pen exercises.

INSTITUTIONAL SUPPORT TO ACTIVE LEARNING

The following six key recommendations can be made which are considered to be essential for the successful adoption of a PBL approach in the mainstream school setting:

1. **Student support**: Students need to be effectively guided and supported; emphasis should be given on effective time management and student self-management, including making safe and productive use of technological resources.

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2. **Teacher support**: Regular support needs to be offered to teachers through regular networking and professional development opportunities. The support from the school senior management is crucial.

3. **Effective group work**: High-quality group work will help ensure that students share equal levels of agency and participation.

4. Balancing didactic instruction with independent inquiry method work will ensure that students develop a certain level of knowledge and skills before being comfortably engaged in independent work.

5. Assessment emphasis on reflection, self and peer evaluation. Evidence of progress needs to be regularly monitored and recorded.

6. An element of student choice and autonomy throughout the PBL process will help students develop a sense of ownership and control over their learning.

PEDAGOGICAL APPROACH TO ACTIVE LEARNING

Research shows that Problem-Based Learning, works to engage students and provide them with life-long learning skills. This teaching method leads to higher retention rates and improvements in critical thinking skills. Teachers in project based learning classrooms are responsible for encouraging students to take charge of their own education rather than the teaching and testing model that tends to be the standard in schools today.

Project-Based Learning looks intimidating to many teachers who work within prescribed traditional curriculums. It seems like quite a stretch to get there from where their teaching methods currently stand. But it doesn't have to be as all-encompassing as you might imagine, and the changes you make don't need to be drastic.

Most teachers already use projects in an effort to evaluate whether students are grasping an important concept well enough to really use them in real life. With a few adjustments, the projects currently in use can take on the hallmarks of project based learning to help students improve critical thinking skills and empower them to take their education into their own hands. Here are a few ways you can begin to incorporate the principles of project based learning into your traditional classroom.

- **Adjust project timelines so that students are learning material *during* the project rather than assigning projects to gauge whether material was learned**

  Make learning a part of the whole project rather than the project acting as an assessment of what was learned. Alter the way students typically carry out projects by presenting the problem first. Give students a real-world problem at the beginning of the unit that they'll work on solving throughout.

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The material used doesn't necessarily need to change that much. The lectures, resources, and homework you've always associated with a unit will work just fine with a project based learning approach. You're simply offering students a different perspective, where the problem presented at the beginning of the unit gives them a tangible reason to soak up the information provided in a way that they may use it their whole lives through.

- **Assign benchmarks throughout the projects to create milestones for grading and ensuring student success**

  Teaching in the traditional school model means grades and assessments are a must. Project based learning doesn't by any stretch mean that these things go out the window, simply that you'll insert grade checkpoints into projects. These checkpoints not only allow you to keep up with traditional grading requirements, they also allow you a formal space to assess student development over the course of the project.

- **Prepare in advance to offer students flexibility**

  When you put students in charge of their education, their needs will inevitably vary. Some kids will zoom ahead, grasping the concepts with ease and developing a passion for the subject. Others will flag, wondering where and how to find the information they need to succeed and generally struggle with the subject matter and the development of critical thinking required in these all-encompassing projects.

  When the goal is to empower students to learn and think critically their whole lives this flexibility is crucial. As the facilitator in Problem-Based Learning, it's the teacher's job to provide students with the tools they need to learn to the best of their ability. Likely, this will mean preparing projects so that they are adjustable, offering various pathways that lead to thought-provoking challenges for students of all levels. This provides for every child a way to succeed through hard work and perseverance.

  Allowing flexibility and assigning benchmarks that uphold the ideals of Problem-Based Learning make the acquisition of lifelong learning skills your top priority in the classroom (rather than a simply mastery of the materials). This is at the heart of why great teachers do what they do. The most important thing for teachers who want to adopt a more project-based strategy should be to keep in mind that small steps can lead to big changes in student learning.

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IV. PBL LABORATORY

Some partners do not have a specific space or institutional support, but are implementing:

- Collaboration strategies between students in classes;
- Other equipment like smart TVs;
- Educational platforms like Moodle;
- Video showcasing in classes.

Other partners already have spaces adapted or integrated options to facilitate the movement inside the university space.

One significant aspect is to search for guidelines about how to adapt the space to PBL, and partners from the United Kingdom and Estonia are going to search for that kind of information in their own universities to understand if can be used as a model or auxiliary template.

In terms of institutional support, it's important to be aware that some institutions may require authorization from their Ministry of Education in order to implement PBL projects; and the financial support towards buying the necessary equipment.

Focusing on the teachers, it is important to offer incentives as a way to motivate them like:

- Organization of workshops about PBL;
- Provision of adapted start up content to the teachers - have some guidelines to show how to save time adapting what they already have;
- And instigate teachers to implement an interdisciplinary strategy.

In terms of space, partners agree that it's important to have flexible rooms to adapt to space limitations (indicated as a problem for some partners, specially, from Asian countries). Tables may be something dispensable, and the chairs movable to facilitate interaction. Screens should also be portable in order to adapt to space configurations, which may vary with the number of the students involved, and to be used in different university locations.

In terms of expected difficulties, 1st and 2nd year students may struggle applying PBL once they are still developing skills necessary to be active in their own learning process. Additionally, classes with a big number of students may provide challenges.

Partners revealed that the ALIEN PBL platform is something important in the development of the PBL Labs, once it may provide technical support.

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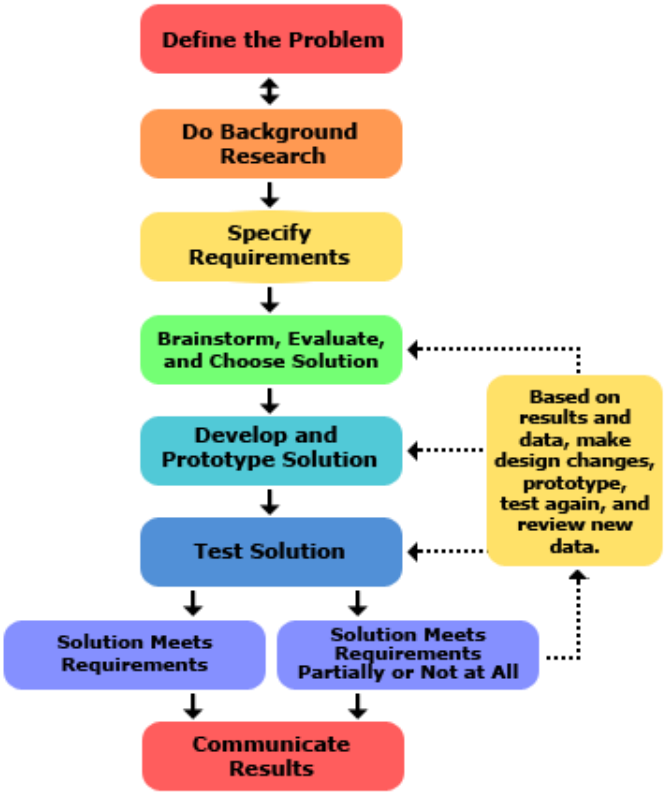
IV. PBL PLATFORM

ALIEN PBL APPROACH



STEP 0: The consortium (later, the teachers) select and formulate the topic and the learning goals and achievements. Identify/define the problem.

The consortium (and later, the teachers) must here plan how and what the students must learn and how to explain it for them. The learning goals can relate to the curriculum of a special subject, or it can be related to students getting special competences, knowledge, techniques of general or specialized character of a particular subject or theme. The learning goals and achievements are the foundation for which problems and themes, the teacher selects to inform and explain the students about their task and how they will work with the task.

If possible, the teacher identifies different learning goals and progression stages to accept that individual students not learn equally fast or have the same possibilities for learning.

PRE-STEP: Define groups, setup logistics (platform and other resources), organize platform tools

Teachers and students register at the platform. Teacher sets up groups, gather resources, etc. The students use the logbook in ALIEN to record what they use their time on, and what they learn from each resource they investigate. The teacher must have access to this logbook.

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The teacher is present and can overlook the work either in class or online on the platform at any time. The students can work and cooperate face-to-face or online through the platform. The teacher can measure the progress of the students by the pre-and after reflections. The teacher should assume a role of a facilitator to support the students in the right directions. Dependent on variations in groups and how well they work and how skilled the students are, the teacher may provide more clear directives with some groups than other groups to make sure that all groups accomplish something.

STEP 1: Explore the problem statement and topic. Background research

The students shall work in groups to analyze the problem. This means writing questions, and ideas, looking into books and other material they have at hand to understand what the problem statement is (the problem they will work with). The students ask themselves: “what do we know”?, “What do we need to know”?, “How can we find out what we need to know”?

As part of this step, the students can identify what they need to know, and do project planning and allocation of tasks. Through games, or simulation cases related to the problem and topic, the students can get a better understanding of what they need to know. The teacher needs to support this step by discussing the relevant need to know parts and how the students plan to gain the knowledge, as well as how to allocate the time for each task. Through the-need-to-know-list, the teacher has a clear indication of the starting point for the students as a basis for understanding and measuring the progression later.

The teacher must be aware that there is a chance that different student groups will work with different problem statements related to the topic. Furthermore, the teacher can engage in a discussion with the students about the problem statement and the way it can be answered/solved and in that way direct the students to do change in the problem statement.

Students can consult experts, read books, or read, or watch other relevant material that the teacher can support them by identifying. There is here also the possibility that the students do empirical work, surveys or interviews if that is relevant in relation to the questions they need to have answer to.

This step takes longer time. The ALIEN platform can be used here, if teachers have placed video’s, or have identified games or simulation cases that the students can use as a basis for their learning about the questions.

STEP 2: Investigate the problem. Specify Requirements

Here the students collect data to answer to the questions. They identify the requirements for the potential solutions and they can identify resources and tasks to undertake to solve the problem.

STEP 3: Identify possible solutions. Brainstorm, evaluate and choose solution

The students describe different solutions and actions to the questions they identified in Step 2. Furthermore, they should answer the overall problem statement they did in Step 1. They should try to explain why they think that is the solution and discuss if there is any problems or other ways to look at another solution. Solutions can be made in various ways – as a game, as a video, as a report, as a poster, with diagrams, calculations, or with relevant laboratory work as basis. The ALIEN platform can be used to upload the possible solutions and for the students to compare and share information on another groups’ work. Students finally decide on the best solution.

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The teacher must support the students in this process by discussing the pros and cons of the answers and making sure that the students have found that is associated with the learning goals of the exercise. At the same time, the teacher can here see the progress that the students have made both by talking with them face-to-face but also by looking at their solutions at the platform.

STEP 4: Develop and prototype solution

With the help of the teacher, students implement the selected solution (this might not always be possible, it depends on the actual problem).

STEP 5: Test solution

Test the solution and measure results. Iterate to step 4 if necessary (results do not correspond to the problem solution, are not efficient or should be improved).

STEP 6: Present the findings. Communicate results

The students should present their findings to other students and the teacher. This can be done in oral presentations, through videos or others agreed by and with the teacher.

At this stage, the students should fill-out a self-reflection form including questions how well they understand the questions now, and how the group work has been. This self-reflection form is something the teacher can do and share with the individual students at the ALIEN platform. In these reflection forms, the teacher can get an idea of how the students see him/herself and can use that along with the information from the other steps to understand the progression of the individual students. The self-reflection represents a sort of review of how the process and learning process has been and can point to how the students can become better for the next project.

ALIEN PBL PLATFORM SPECIFICATION

(1) GENERAL REQUIREMENTS

- Should support the community and the features should be used by everybody, should be user-friendly with a great emphasis on the spirit of community and collaboration;
- Should allow users to access content related to the domains chosen. That said, can`t be too generic;
- The target group of the community should be clear: teachers or students (or both) and what type of engineers (from all Engineering fields or just from a specific one);
- Each domain, depending on the target, should have a specific platform (starting from a generic data base);
- Work as a meeting point that provides solutions to the community;
- Include different strategies of active learning with different activities and adapt the community with that in mind (have an option to select which one);
- The platform should reflect the different stages of PBL and manage the learning process;

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- Include team work support and extra functions, including communication systems and sharing of information, debates, discussion groups and video reactions.
- Should also include evaluation, applying digital systems (composed of multiple questions with the same level of difficulty):
    - Constant monitoring of results;
    - Also, a test to evaluate the learning experience and understand how the students see the experience, providing a more active evaluation and including peer review. Additional, the evaluation should include the reflection of students, written in a report.

Additionally, the platform should permit:

- Organization of teams to report problems.
- Students can produce evaluation content and problem creation for sharing purposes;
- Should have a list of types of PBL and find software that could help students — a template with multiple interfaces;
- Problems related to software development;
- Applying the same strategy with members from different areas and promote reflection — including the premise of “learning by failure”;
- Multidisciplinary approach and focus on problem solving;
- Explore the strategy of collective storytelling;
- Inclusion of automatic complier to decide if the solution in case is correct or not. That would facilitate evaluation;
- Translation system in the back end and platform translation into English. Other languages could potentiate more users.

In terms of difficulties, it is advisable to be aware that:

- The platform can´t be too difficult to use — it should be user-friendly;
- Having to create external platforms to accommodate the community (depending on the institution);
- Teacher training (if teachers have training in this area or are from a specific Engineering field, they might be able to do it alone, but if they don’t, it can be hard for them and training should be provided);
- Should facilitate the transition for teachers (apply some similarities of other existent systems);
- There are different time zones when students are playing and therefore it becomes necessary to handle this issue when students are playing in teams from all over the world;

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