ALIEN Active Learning In Engineering Education

# D2.1 RESEARCH METHODOLOGY

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| **Authors** | Carlos Vaz de Carvalho |
| **Reviewer** | Hariklia Tsalapatas |
| **Contributors** | All partners |
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# INTRODUCTION

The aim of the ALIEN (Active Learning in Engineering) project is to improve the quality of higher education by providing more motivating, stimulating and effective learning contexts that prepare students for their professional life by allowing them to actively develop the required competences.

To achieve that, the ALIEN consortium will design, implement and validate an Active Learning context based on Project/Problem-Based Learning (PBL) methodologies addressing real-life issues related to science, technology, engineering and math (STEM) concepts. The methodology will be supported by a Virtual Learning Environment (VLE) integrating a set of digital tools that will allow teachers and students to experiment, collaborate and communicate in an extended and multinational learning community that will also include other stakeholders like educational managers and researchers.

As a first step in this process, partners are required to do an extensive state of the art analysis namely in terms of existing best practice in the use of Active Learning and PBL (focussing on institutional and pedagogical levels), in terms of teachers and students needs and also in terms of the VLE requirements. This research will then guide the design and development stages of the project.

This document presents the planned research methodology that partners should adopt to produce an institutional strategy for the adoption of AL and PBL (deliverable 2.1). It is also meant as a consultation tool for other similar studies.

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## ALIEN PROJECT

The ALIEN project is expected to create and disseminate an Active Learning approach in Engineering Faculties in Europe and Asia. The methodology will be supported by a VLE integrating a set of digital tools that will allow teachers and students to experiment, collaborate and communicate in an extended and multinational learning community that will also include other stakeholders like educational managers and researchers.

As such, the project mainly targets teachers and students from Higher Education in Engineering and Technical careers but also the organizations themselves, as there is the goal of changing the pedagogical methodologies as an institutional strategy. Teachers will be able to apply the Active Learning methodology and the tools to be developed in the project and the students themselves will benefit from a more motivating pedagogical context and will be more attracted to these subject areas. The HEIs will benefit from adopting a more active pedagogical approach and will be able to attract more students by establishing closer links with the society and the labour market.

As concrete results, the project will produce:

- A strategic plan to be adopted/adapted by each institution on the use of Active Learning and Problem/Project Based Learning;

- A validated pedagogical methodology that promotes Active Learning through the use of ICT tools.

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# RESEARCH GUIDELINES

As a first step in the ALIEN project, partners are required to do an extensive state of the art analysis namely in terms of existing best practice in the use of Active Learning and PBL (focussing on institutional and pedagogical levels), in terms of teachers and students needs and also in terms of the VLE requirements. This research will then guide the design and development stages of the project.

## SCOPE

The research project results will be compiled in an institutional strategy proposal for the adoption of AL and PBL, project deliverable 2.1., integrated in Work Package 2. This WP respects to the specification, design and development of all the outcomes of the project which includes, besides the institutional strategy, the PBL virtual learning environment and the pedagogical methodology associated with it, the lab design, the problems and the support tools. The lab is expected to work as a place where teachers can create and test their own problems, where they can connect to the virtual community of teachers and researchers and where practical sessions with students can take place. Therefore this WP includes the conceptual aspects but also the technical aspects related to the platform. An important aspect on the specification relates to the need to focus on the specificities of the Engineering field in comparison to other academic disciplines.

In the WP, the following tasks are expected to produce the desired results:

T2.1. State of the art analysis: Analysis of existing best practice in the use of Active Learning and PBL (institutional and pedagogical levels); Analysis of existing ICT tools for project management; Analysis of existing games and simulations to support PBL; Analysis of virtual community requirements;

T2.2. Draft the institutional strategy for AL and PBL adoption; Definition of PBL Lab requirements;

T2.3. Definition of the pedagogical methodology and possible models of use of the platform; design validation methodology;

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T2.4. Design the PBL environment: needs analysis, graphical design aspects, simulation engine; design of exemplary problem cases; design of supporting ICT tools (games and simulations);

As part of the success indicators for this WP the following three related directly to the specification and design stages:

- Level and scope of the documentation produced;

- Quality of the analysis of the state of the art;

- Quality of the AL methodology specification.

This document presents the planned research methodology that partners should adopt to produce the expected results. It is also meant as a consultation tool for other similar studies.

## GUIDELINES

The present guidelines contains the methodological framework for the research that will be implemented in order to produce the state of the art report and then the institutional strategy deliverable. Qualitative and quantitative methods of data collection, the selection of relevant stakeholders, the relevant sources for good practices, etc., will also be described here. The framework is composed of the following steps:

1. Creation of the research methodology
2. Desk research stage in all partner countries (compulsory)
    a. Generate individual reports
    b. Compile in national state of the art report
3. Field research in all partner countries (voluntary)
    a. Add to national state of the art reports
4. Compile national state of the art reports in global document (draft version)
5. State of the art report final version
    a. Validation by partners and external experts

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b. Translation in partner languages (voluntary)
c. Publish the final report

## Desk research (compulsory)

For the desk research partners were requested to collect data to support answers to the following items:

- Overview of the national situation
- Existing national/local/institutional initiatives to promote Active Learning (preferably at the University level and particularly in Engineering)
- Best-practice cases (2, 3) in the use of AL/PBL, specifically those that already are supported by ICT tools
- Current AL use on the partners' organization itself

Partners should adopt a scientific approach in the collection of data namely using standard systematic research techniques (like the PRISMA systematic review approach[1]) and the used references should be listed to produce later a general AL reference data base.

Partners can use whatever quality resources they can find at organizational, national and worldwide levels, such as journal and conference articles, organizational or governmental reports, textbooks, web resources, etc.

The individual report should result in a document structured according to the item listing shown before. The document should include a conclusions section that summarizes the findings identified.

[1] http://www.prisma-statement.org/

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All individual reports form the same country should then be merged in a national report (of course, partners from the same country can prepare and do the desk research together, anticipating this step).

This national report will then produce:

- An analysis of the current national situation (and eventually in the neighbouring regions if the partners find it relevant for a regional context);
- An analysis of teacher and students' needs
- An identification of future trends

It is expected that these national reports could be published in conferences or journals with national or regional scope.

### Field research (voluntary)

In case partners find that the desk research did not provide enough information to address some of the topics (namely in terms of teacher and students needs), they can do a field research approach with teachers and students namely through focus groups or surveys. Partners can also include other stakeholders in this stage, like external experts or educational managers.

Because this stage is dependent on the identified gaps in the collected information it is up to the partners to design the procedures and data collection tools. In any case, they should follow established good scientific practices for both approaches (focus groups and surveys) so that results can later be published in scientific conferences or journals. Namely, for the surveys, it is important to get a statistically significant number of respondents.

For all these events, partners should always start by introducing the project and its objectives. It is also important to present at that moment all aspects related to General Data Protection Regulation (GDPR) that could affect respondents.

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The results of the field research will then be integrated in the national state of the art report. The report should include then the characterization of the involved persons (namely how many and their role: teachers, students, managers, etc.).

### Compilation of national reports

The WP Leader will produce a compilation of national reports that provide a general overview of the three points addressed before:

- An analysis of the current situation in the use of AL in Engineering Higher Education;
- An analysis of teacher and students' needs;
- An identification of future trends.

It is not expected to provide a comparative national study but differences between Asian and European regions could be brought up for comparison with the programme objectives.

The final report will be subject to validation by partners and any other external reviewers they want to bring in. The final version will then be published.

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