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Approach to developing online educational materials based on Acoustics Knowledge Alliance (ASKNOW) project

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ABSTRACT

Creating online educational materials may be much more complex and multidimensional than can be expected. It typically involves many unseen aspects. The aim of this article is to show this complexity and outline these aspects, based on the Acoustics Knowledge Alliance (ASKNOW) project co-founded by the Erasmus + Programme of the European Union. In this project, the goal was to deliver a great quality, reliable, and comprehensive educational tool, and to introduce all topics in an interesting, appealing and attractive manner. The emphasis was placed on a very high content quality, therefore the partners were carefully selected and the materials were prepared by both science authorities and top-class professional experts. The topics that will be discussed in the article are: general working method, managing an interdisciplinary team, rules for creating online content, quality assurance and evaluation, and dissemination of project results.

Keywords: *online educational materials, training platform, hands-on learning*

1. INTRODUCTION

The main goal of the project was to provide interactive, open-access educational materials for students, lecturers in Higher Education Institutions (HEIs), professionals, and company engineers. The vision for this English-language acoustic courseware was to design and combine lessons and practical cases into an innovative online learning experience. In this article, we highlight the major aspects of the three-and-a-half-year collaboration. The project team worked on five courses as part of the ASKNOW project [1]: Acoustics Fundamentals, Psychoacoustics, Acoustical Simulation and Auralization, Electroacoustics, and Room and Building Acoustics. This work coincided with the Covid-19 pandemic, which posed an additional challenge for the entire project team.

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2. GENERAL WORKING METHOD

The ASKNOW project involves eight partners - four Higher Education Institutions (HEIs) and four enterprises - from five European countries, along with twelve associated partners. To ensure efficient workflow, the project activities were divided into thirteen logical Work Packages (WPs), each aimed at producing specific results. Fig. 1 illustrates the partnership and workflow of the ASKNOW project.

Figure 1. The partnership and workflow of ASKNOW project.

Obtaining results from each block of activity was a prerequisite for moving on to the next stage and ultimately achieving the project's goals. The materials prepared had to be verified by the partners before further implementation of the project work. Each partner had a fundamental role to play in defining the stage results of the project and was responsible for creating and developing these results in terms of science and in the context of the project strategy. Management, quality assurance, internal and external evaluation, and dissemination activities were integral components that spanned the entire lifecycle of the project, ensuring smooth task execution and high-quality results. Implementation was one of the most crucial stages in which all educational materials were produced. Activities and methodologies for creating substantive content and online results are described in detail in Section 4 of this article.

3. MANAGING AN INTERDISCIPLINARY TEAM

Interdisciplinary collaboration is becoming increasingly crucial in higher education, as it can drive knowledge advancement and foster innovative solutions to educational challenges. The development of online educational materials that effectively communicate scientifically complex issues in an engaging and accessible manner requires interdisciplinary partnerships. The diversity of thematic areas covered in the project necessitates the involvement of specialists from various fields, as presented in Fig. 2.

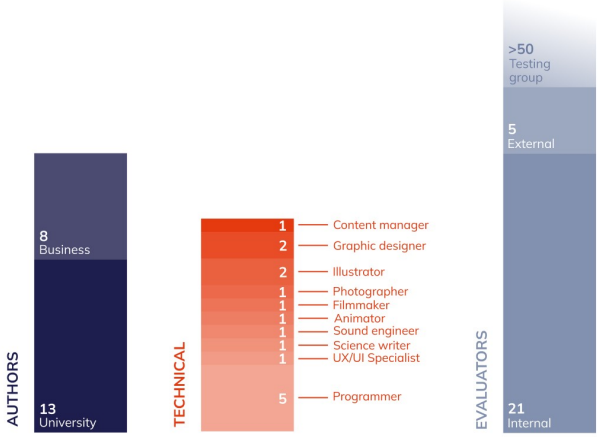

Figure 2. The interdisciplinary ASKNOW team. The number of professionals contributing per role is indicated.

3.1 Communication

At the outset of the project, it was essential to establish common rules and a shared vision among all partners to ensure the quality of the final product. To achieve this, preparatory meetings were conducted during the application phase and again after the project's initiation. In addition, a remote collaboration environment was created to facilitate effective cooperation and provide access to all project data.

To ensure efficient communication among all consortium members, team collaboration software such as Mattermost and Airtable were utilized. These tools allowed for dedicated channels to be established for various work packages and project-related topics. Regular online meetings of the entire project team and subgroups responsible for individual courses were held quarterly. Minutes of the meetings were prepared, providing a detailed summary of the discussions and task distribution.

3.2 Progress

To monitor the progress of the project and ensure the timely implementation of work packages, an online progress chart was shared among the consortium members. The chart indicated the development of each lesson and practical case in percentages (100% indicated completion). These percentages enabled the consortium and the project coordinator to assess the overall progress and compliance with the initial work plan and make necessary adjustments. Additionally, the tool allowed the consortium to keep track of the exact dates of different types of meetings.
The evaluation of the lessons was monitored by tracking proofreading efforts and various deadlines, providing an overall follow-up for all members and input from everyone. Furthermore, statistics were made available to partners involved in co-creating educational materials (lessons) to keep track of the current consumption of working days and responsibilities (different roles: responsible for the lesson, supporting, and consulting).

4. RULES FOR CREATING ONLINE CONTENT

Since the Covid-19 pandemic began, there has been a significant increase in awareness of online educational possibilities, along with a growing need for materials in digital form. The objective of the ASKNOW project was to create courses that were visually appealing and enjoyable to learn, while maintaining a high level of content quality. The courses are hosted on the ACOUCOU platform under the CC BY-NC-ND 4.0 license (Creative Commons license) and are freely and easily accessible through browsers. Each of the five courses comprises 30 lessons and two case studies [2]. Users will find a range of visuals and interactive features, such as the ability to change the value of a parameter, play a sound sample, move an object, or observe changes in a simulation. Fig. 3 illustrates the approach taken to develop the ASKNOW online educational materials.

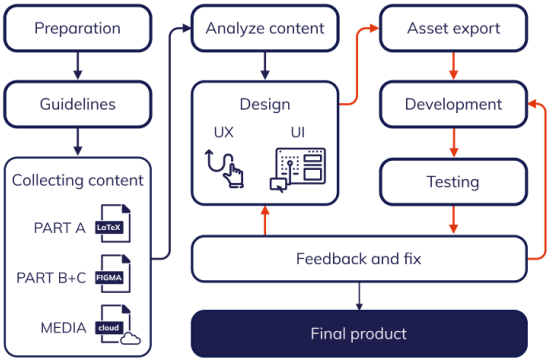

Figure 3. Workflow of development of ASKNOW educational materials.

4.1 Preparation and Guidelines

The objective of this work package was to establish guidelines and consult on the content of the substantive materials. This involved conducting a detailed analysis of the needs of the target audience, which was carried out by both partners and associated partners. The outcome of this analysis was the creation of a clear distribution of tasks among the team members, ensuring that each partner had a well-defined role in the project.

4.2 Development of Educational Content

This work package was undertaken by a team of academic professors, tutors, and specialists with the objective of creating high-quality educational materials. To facilitate the efficient conversion of raw material into a finished product, a unique set of tools and templates were established for authors. To ensure editorial consistency, the Chicago Manual of Style [3] was utilized. Standard-compliant usage of quantities, units, and equations was based on ISO 80000 Quantities and Units — Part 1: General [4]. The consortium also established a unique graphic design theme and component libraries for internal use to maintain design uniformity across visuals.
Each lesson is divided into three parts: theory (A), principle part (B), and task part (C), as illustrated in Fig. 4. The first part presents the theory behind specific acoustics phenomena through mathematical formulae, figures, charts, and videos. The second part is interactive, allowing users to understand the concepts discussed. The task part comprises a different task that users must complete at the end of each lesson, such as quizzes, drag & drop, complete the value, or connect lines.

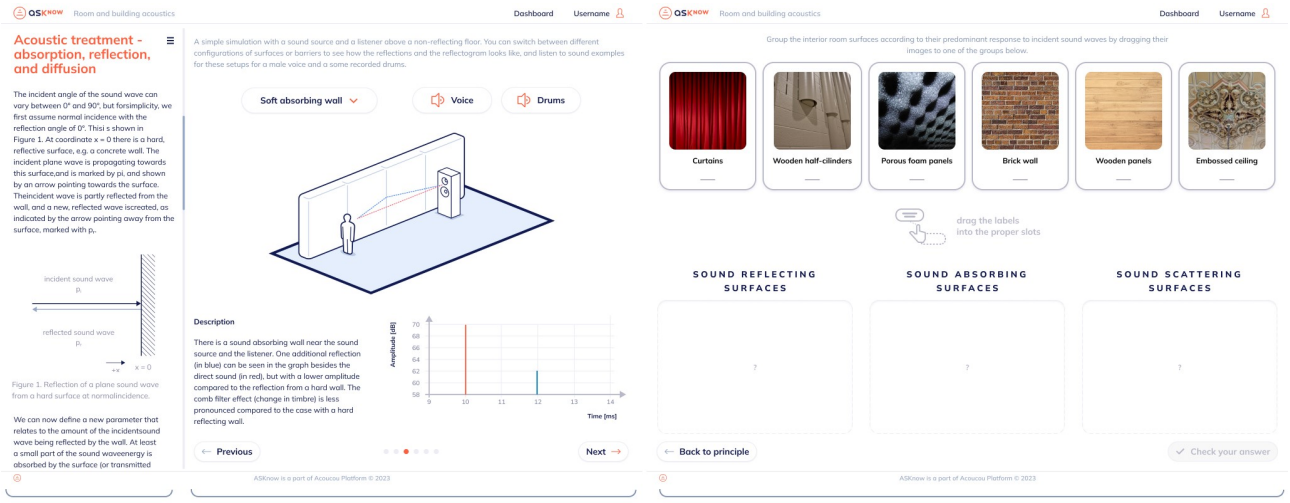

Figure 4. Exemplary lesson ready to be converted into web-based course. Each lesson consists of three parts: the theory part (part A), the principle part (part B), and the task part (part C).

4.3 Compiling and Adapting Knowledge

The objective of this work package was to analyze the filled templates received from authors and integrate their content into the original web-based methodology. The goal was to ensure that all materials were complete and free of missing elements before being delivered to the technical team for further development. To achieve this, all materials underwent a thorough check and were supplemented with any missing elements. The team aimed to ensure that the materials were not only factually correct but also presented in a clear and concise manner. The final product was then tested by the target groups to ensure its effectiveness and usability.

4.4 Development of Courseware

As part of the "Design" activity, a variety of audiovisual materials such as infographics, sound samples, video tutorials, graphics, and animations were created. These materials were produced in formats that allowed for presentation to the testing target groups and could be easily converted into a web-based course. In the "Development" activity, the focus was on ensuring a seamless User Experience (UX) and User Interface (UI) design, as well as completing all necessary programming tasks to fully implement the online tool. The team worked on developing and refining the product until it was ready for its final release on the ACOUCOU platform [5-6]. To ensure the success of this phase, the team worked collaboratively, ensuring that all aspects of the tool were integrated and optimized for the user's experience. Fig. 5 displays an overview window of one of the ASKNOW courses.

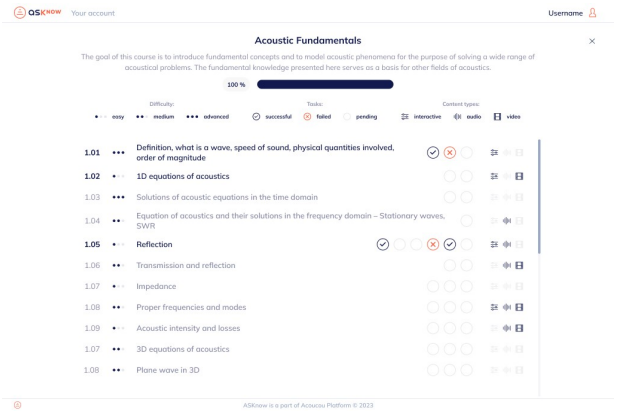

Figure 5. One of the ASKNOW course overview.

5. QUALITY ASSURANCE AND EVALUATION

5.1 Testing and monitoring

The quality assessment was a comprehensive process involving representatives from all partners. A quality plan was developed and performance indicators and project milestones were monitored at each stage of project implementation. The review process was carried out in multiple phases. In the first phase, an internal group that developed a particular set of educational materials

conducted a review. In the second phase, technical partners checked for possible errors and assessed the ease of porting the resources to an online platform. In the final phase, external experts and representatives of target groups outside the consortium were invited to provide review and feedback. A complete list of these experts can be found in the acknowledgments section. The feedback was collected in the form of written comments and used to improve the quality of the materials. The survey tools used in the project are presented in Fig. 6 and Fig. 7.

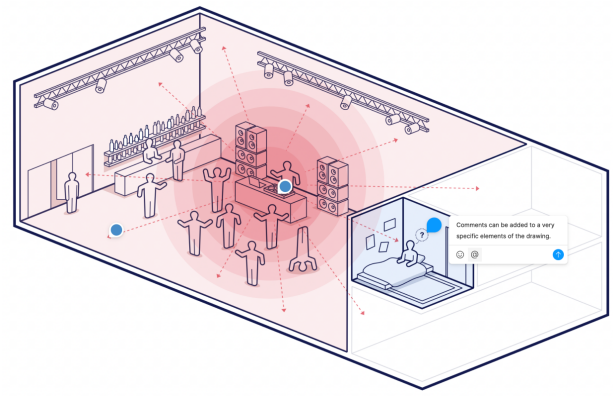

Figure 6. An example of comments on a prototype lesson using comment mode.

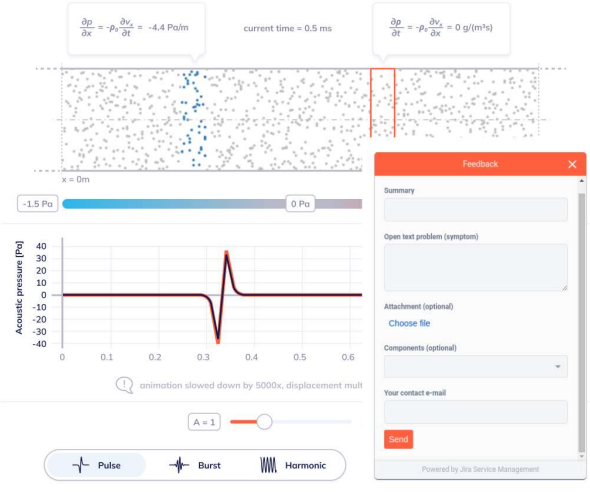

Figure 7. Example feedback screen for an online lesson prototype.

Results from the testing phases were carefully analyzed during partners' meetings, and the necessary modifications were made to the course content. After the reviewing stage and introduction of all required changes, all materials were compiled and prepared for conversion into e-learning format. The final product underwent evaluation and was tested by the target groups once again. Any necessary changes were implemented based on the results of this testing. The testing flow is presented in Fig. 8.

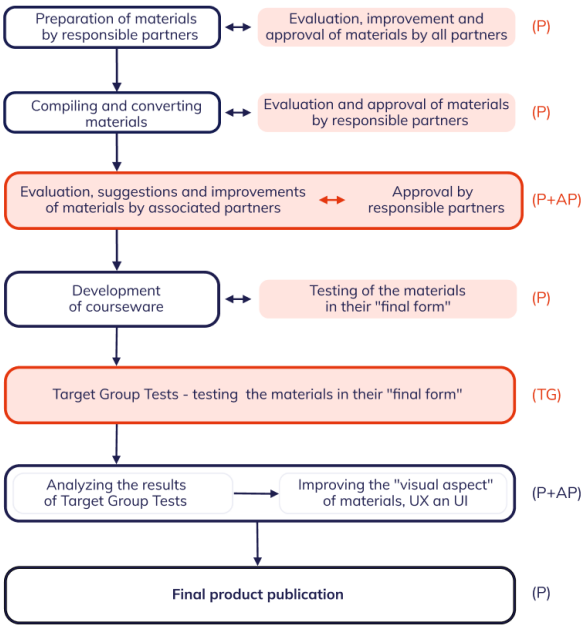

Figure 8. Testing and reviewing process on different project stages.

5.2 Evaluation

Evaluation was conducted both internally and externally at each key stage of the project, ensuring complete transparency and joint decision-making based on the results of the indicators. The achievement of objectives and outcomes will be evaluated based on statistics related to course participation, which can be tracked using various metrics and user behavior data. The system also monitors and saves all user actions and work progress, allowing for the generation of certificates based on the database. The dashboard displaying the course progress can be seen in Fig. 9.

Figure 9. Dashboard with course progress.

6. DISSEMINATION OF POJECT RESULTS

To ensure the widespread applicability, visibility, and accessibility of the project's end results, dissemination and exploitation activities were integrated throughout the entire project lifecycle. The primary aim was to engage professionals, students, and teachers, who are the end-users of the project's results. To reach these groups, a variety of dissemination activities were implemented, targeting HEIs organizations, enterprises, and various acoustic associations of entrepreneurs and employers. Each partner utilized their existing networks to disseminate the project's results, while also reaching out to organizations and associations that collaborate with universities and enterprises. Associate partners were also actively involved in disseminating project information to target groups. The project's dissemination activities were designed to maximize their effectiveness and included a wide range of strategies such as workshops, seminars, webinars, conferences, publications, newsletters and social media. These activities ensured that the project's results were widely distributed and easily accessible to the target groups.

Figure 10. Material from the promotion campaign of the ASKNOW project.

7. SUMMARY

Based on the experience gained during the three-and-a-half-year process of creating the ASKNOW course, as well as developing previous ACOUCOU courses, it is evident that producing high-quality online educational content is a highly complex task. It requires the involvement of specialists in each scientific or technical field, as well as careful management and workflow methods. To create online tools that not only have high-quality content but also follow modern trends in presenting knowledge, a multidisciplinary team is necessary. Managing such a team poses many challenges, and the course development process consists of various overlapping stages that require a careful and systematic approach. The authors of this article aspire that the insights and recommendations shared herein will support and empower the reader to create high-quality educational materials efficiently, creatively, and with ease.

8. ACKNOWLEDGMENTS

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