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Guidelines on how to design learning for online and interdisciplinary project-based courses

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D1.7 Guidelines on how to design learning for online and interdisciplinary project-based courses [v1]

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1. Introduction

Teaching methods vary widely, which is positive but can sometimes be challenging. We seldom start from scratch when designing courses. This guide shares the best practices we've learned from our experience teaching and designing project-based master's programs and online courses.

These insights are primarily from our experiences at Tampere University in Finland, specifically within the Sustainable Digital Life (SDL) master's degree programme. This master's programme, established in 2020, was designed with a strong emphasis on project-based learning. From the start of their studies, students began working on projects, which they eventually completed as part of their theses. Alongside these major projects, students also engaged in smaller, project-based courses throughout the programme.

Inquiry-based learning (IBL) and project-based learning (PBL) are teaching approaches based on the idea that students learn best by actively engaging with the world. These models focus on letting students take the lead in their learning through exploration, asking questions, and solving problems (Muukkonen & Lakkala, 2009; Damsa & Muukkonen, 2020).

Inquiry-based learning is a student-centred approach where the learner actively participates in the educational process. The learning journey begins with a question or problem posed by the student, the teacher, or the stakeholder. To find answers, students engage in hands-on activities, experiments, or research, allowing them to explore their questions (Järvelä, Järvenoja & Muukkonen, 2021).

Students are encouraged to think critically, analyse data, draw conclusions, and reflect on their findings throughout the process. Teachers provide support alongside possible stakeholders and gradually guide students to take more responsibility for their learning. Students often work in groups to share ideas and solve problems together (Muukkonen, Lakkala & Hakkarainen, 2009; Lakkala, 2010).

Project-based learning focuses on real-world challenges that matter to students, making their work more engaging. Students can choose the topics of their collected themes for their projects and decide how to approach their work. They dive deep into their chosen topic, conducting research, experimenting, and refining their ideas over time (Larmer, Mergendoller & Boss, 2015; Vesikivi, Bauters, & Holvikivi, 2021).

This guide will begin with tips on creating online courses in Chapter 2, covering key areas such as materials, accessibility, assignments, instructions, and interaction. Chapter 3 will then focus on the insights we've gained in designing and teaching interdisciplinary online courses, providing guidelines that address general aspects and considerations for students and external partners.

2. Online Courses

Given that many of the AISS courses are delivered as online or hybrid courses, several important considerations must be kept in mind. The tips shared here are particularly drawn from our experiences teaching asynchronous, self-paced online courses, though they are broadly applicable to any course or

content you create. This section will first address creating accessible materials and guide selecting appropriate material formats. Next, we will discuss assignments, focus on fostering interaction, and provide advice on crafting clear instructions.

2.1 Accessibility

Approximately one in six individuals have some form of disability, making it likely that students with various disabilities will be enrolled in your courses. Disabilities can include challenges related to vision, hearing, physical abilities, or neuropsychological conditions. Since many disabilities are not immediately visible, especially in online courses, it is crucial to ensure that all teaching materials and activities are accessible.

The tips provided here particularly benefit students with visual, hearing, and cognitive disabilities. However, it's important to note that creating versatile and accessible content ultimately benefits everyone. Ensuring that online teaching meets the following accessibility standards not only helps students with disabilities but also enhances the learning experience for all students.

2.1.1. Videos and audio

1. **Describe All Relevant Visual Content Out Loud.** Always provide verbal descriptions of visual content, especially when students cannot view slides or other visual materials. Avoid phrases like “As you can see from the slides” and describe key elements directly instead. For example, explain graphics clearly: “This infographic shows the proportion of people with and without disabilities, indicating that one in six people has a disability.” Additionally, in your first video or lecture, describe your appearance and the setting to help students who may not see you.
2. **Include Subtitles or a Transcript for Videos.** Provide subtitles or a transcript for all video and audio materials. This is particularly helpful for students in noisy environments or with hearing impairments. Automated tools can generate subtitles or transcripts, saving significant time and effort while providing essential accessibility features.

Further tips: Planning Audio and Video Media | Web Accessibility Initiative (WAI) | W3C

2.1.2. Making documents accessible

1. **Ensure Good Contrast Ratios and Colour Visibility.** Ensure texts are easily readable against their background by checking contrast ratios and colour choices. Use tools to help with this, such as colour contrast checkers, to ensure text visibility.
2. **Avoid Conveying Information Solely with Colours.** Do not rely on colour alone to communicate information, especially when using similar colours like red and green. For example, avoid using red to indicate negative aspects and green for positive aspects without accompanying textual explanations.
3. **Use Clear Fonts.** Choose fonts that are clear and large enough for easy reading. Avoid fonts that resemble handwriting, as they can be difficult for some students to read.

4. **Provide Alt Text for All Visual Content.** Ensure that all visual content, including images and graphics, includes alternative text (alt text) that describes what is depicted. This helps students who use screen readers to understand the visual content.
5. **Use Heading Styles Appropriately.** Use built-in heading styles in your document or presentation software to structure your content. Do not create headings simply by increasing font size and bolding text, which can affect accessibility and navigation.

Further tips: Make your Word documents accessible to people with disabilities - Microsoft Support

Everything you need to know to write effective alt text - Microsoft Support

2.2. Materials

When designing online courses, you have several types of materials at your disposal, such as:

1. Scientific articles
2. Slide sets
3. Videos
4. Text
5. Audio
6. Images

To choose the most effective materials, first consider your teaching objectives and the best way to achieve them. For instance, if you want students to engage with scientific literature, scientific articles may be the most suitable. Conversely, slide sets, videos, texts, or audio might be more effective for teaching fundamental concepts.

Based on our experience, students prefer courses using text or audio materials. Here are some guidelines to help you design materials for your online courses:

1. **Define Learning Objectives First**. Determine what you want your students to learn and select materials that best support these objectives.
2. **Incorporate Various Material Types**. Use a mix of different materials to maintain student interest and cater to diverse learning preferences.
3. **Opt for Short Videos**. Use shorter videos (around 10 minutes) rather than lengthy lecture videos to keep students engaged and focused.
4. **Ensure High Sound Quality**. Verify that all videos and audio recordings have good sound quality to avoid misunderstandings and improve the learning experience.

2.3 Assignments

Here are some examples of different assignments that you might consider for your online courses:

1. Learning diaries
2. Summaries
3. Multiple choice questions
4. Experiential Tasks (e.g., trying out software or devices and sharing experiences)

When selecting assignments, start by identifying what you want your students to learn and choosing the most effective way to achieve that goal. For instance, learning diaries could be ideal for reflecting on experiences, while multiple-choice questions might better assess comprehension of reading materials.

Remember that students have varying learning styles and motivations, especially in self-paced online courses. Some may focus on earning credits, while others are keen to engage fully with the course content.

Here are some guidelines for designing assignments for your online courses:

1. **Design Meaningful Multiple Choice Questions**. If using multiple choice questions (MCQs), ensure they require a thorough understanding of the materials. This will help ensure that students engage with the content and are not simply completing the course without genuinely learning.
2. **Include Many Shorter Assignments**. Use numerous shorter assignments throughout the course rather than one large assignment at the end. For example, assign tasks after each lecture to keep students actively engaged and provide frequent feedback.
3. **Diversify Assignment Types**. Incorporate various types of assignments to maintain interest and cater to different learning styles. If possible, allow students to choose the format of their submissions, such as essays, videos, slideshows, or podcasts. Consider whether all submissions need to be in a specific format or if flexibility can be provided.
4. **Encourage Experiential Learning**. Design assignments that involve hands-on experience, such as trying out software or devices. This approach helps students learn through doing rather than just theoretical instruction.
5. **Foster Peer Interaction**. Use forums for assignment submissions to encourage student interaction and peer feedback. This can help students see different perspectives and interpretations of the material. However, be mindful that public postings might increase stress for some students, so ensure that this approach suits the needs of your learners.

2.4 Interaction with other students and teacher

Since students have diverse needs and preferences, providing opportunities for interaction with peers and instructors is important. Here are some strategies for fostering engagement in asynchronous and hybrid courses:

Asynchronous Courses

1. **Use Discussion Forums.** Set up discussion forums where students can interact with each other. This encourages peer-to-peer learning and allows students to discuss course material, share ideas, and collaborate on topics.
2. **Implement Peer Review.** Consider incorporating peer review assignments to increase interaction. This allows students to provide feedback to each other, which can enhance learning and foster a sense of community.
3. **Provide Clear Contact Information.** Ensure your contact information is prominently displayed so students can easily reach out with questions or concerns.

4. **Schedule Timed Q&A Sessions.** Arrange occasional live Q&A sessions where students can ask questions and engage in real-time discussions with the instructor and their peers.

Hybrid Courses

1. **Ensure Good Sound Quality.** Ensure that audio equipment is of high quality so that students online can clearly hear what is being said and that those in the classroom can hear contributions from online participants.
2. **Plan Group Discussions Carefully.** Consider how group discussions will be managed, especially if there is an imbalance between online and in-person participants. Develop strategies to ensure that both groups have equal opportunities to contribute.
3. **Facilitate Equal Participation.** Strive to give both online and in-person students equal time to speak and engage in discussions. It's important to be mindful of the natural tendency to engage more with those physically present and actively work to include all students.
4. **Foster Inclusivity.** Ensure that the hybrid format does not feel like a secondary option. Actively work to make all students feel included and valued, regardless of their mode of participation.

Implementing these practices can help to create a more engaging and inclusive learning environment for all students.

2.5 Instructions

Providing precise and detailed instructions ensures students fully understand the course requirements and expectations. Here are tips on how you can effectively communicate this information:

1. **Provide Clear Instructions**. Ensure that all instructions for assignments, general course information, and other relevant tasks are explicit and easy to follow. Ambiguous instructions can lead to confusion and many emails.
2. **Display Evaluation Criteria and Course Objectives**. Make the evaluation criteria and course objectives prominently visible on the course platform. Explain these at the start of the course, ideally during the first session, to set clear expectations from the beginning.
3. **Clarify Evaluation Criteria**. Inform students whether the course is graded numerically or on a pass/fail basis. Clearly describe how each assignment contributes to the overall grade. Specify if some assignments have greater weight than others and outline what is expected for each assignment.
4. **Detail Assignment Requirements**. For online courses, include this information at the beginning of each assignment. For instance, clarify whether the focus should be on the content of an essay or its structure. Explain what you are looking for in each assignment to guide students effectively.

3. Interdisciplinary Project-based Courses

Interdisciplinary project-based courses can vary significantly in duration, ranging from a single term to several years. A common feature is that students work in multidisciplinary teams, which may be diverse in their backgrounds or current fields of study. Typically, the project topics are provided by external stakeholders rather than being generated solely by students or instructors. These topics might include

specific stakeholder needs, such as improving website accessibility, or broader issues, like developing tools to support accessible web design.

This document draws from experiences with a two-year project-based course and offers guidance that may apply to other courses. In the Sustainable Digital Life program, students begin working on a project or "wicked problem" shortly after starting their master's studies. Initially, they are taught project management and are informed that they will take ownership of their projects, making all final decisions. The aim is for these projects to evolve alongside their studies and ultimately form the basis of their thesis.

Students are encouraged to incorporate the knowledge acquired from each course into their project assignments. They can also offer their project topics as part of other courses, such as those focused on user experience, allowing them to involve a broader range of students. Additionally, each year, new students are introduced to ongoing projects. For example, a student who starts a project in autumn 2022 might mentor a new student in autumn 2023, providing valuable background information and continuity.

Organising interdisciplinary project-based courses involves addressing various challenges, such as scheduling conflicts, inactive stakeholders, and insufficient guidance. It is important to recognise that students have different experience levels and may interpret topics and instructions differently. Therefore, this chapter provides guidelines for general instructions. It offers advice for managing students, partners, and supervisors and achieving learning objectives, focusing on helping educators and course organisers navigate these challenges effectively.

3.1 General

This section provides guidelines for effectively managing interdisciplinary project-based courses, focusing on the roles and responsibilities of everyone involved, including students, partners, and supervisors.

1. **Clarify Project Goals and Expectations to Yourself**. Develop a clear understanding of the project's goals. Communicate your expectations for students, partners, and supervisors to ensure everyone is on the same page.
2. **Provide Clear Instructions**. Ensure that all parties involved understand their responsibilities and roles within the project. Clear instructions help prevent misunderstandings and ensure that each participant knows what is expected of them.
3. **Establish a Clear Project Schedule**. Create a schedule for the projects, which can be flexible or fixed. We recommend setting expected deadlines to track progress. For example, students may be required to provide updates or present their work every two weeks, monthly or once per semester.
4. **Engage with Partners Early**. Discuss and agree on project topics with partners well in advance. Confirm that they are genuinely interested and committed for the entire duration of the project.

5. **Organise Discussions for Partners**. Arrange meetings where all partners can discuss the project details and ask questions before meeting with students. This preparation ensures that partners are clear on their expectations and can provide informed feedback to students.
6. **Facilitate Meetings for All Participants**. Schedule meetings that include both partners and students. This allows students to interact with partners and ask specific questions about project topics. Organise at least one such meeting before students select their project topics, enabling students to gather preliminary information and partners to share initial ideas.

3.2 Students

1. **Teach Basic Project Management Skills**. Ensure that students are taught fundamental project management concepts. Do not assume prior experience in managing or participating in project work. Providing this foundational knowledge is crucial for their success in handling projects effectively.
2. **Clarify the Project Goals.** Ensure students fully understand their project's objectives (and how it relates to their thesis). This connection helps students see the relevance of their work and align their project efforts with their academic goals.
3. **Emphasise Ownership and Responsibility**. Clearly communicate that students are the owners of their projects. They are responsible for the project's progress and outcomes. Additionally, inform them that intellectual property rights (IPR) are theirs unless otherwise agreed upon. This clarity ensures that students understand their role and the importance of their contributions.
4. **Allow Students to Propose Their own Topics and Stakeholders.** Even if you have pre-defined topics and interested stakeholders, allow students to develop their own project topics and identify stakeholders, as long as this does not delay the project timeline. This flexibility can significantly enhance student motivation and engagement by encouraging creativity and ensuring students are more invested in their work.

3.3 Partners

1. **Clarify Project Ownership to Partners.** Ensure that partners understand they do not own the project or its outcomes. The students are the project owners and hold the rights to the results unless otherwise specified in an agreement. This distinction should be communicated clearly to avoid misunderstandings about ownership and intellectual property.
2. **Ensure Partner Commitment.** Partners must commit to the project for its entire duration to support the students effectively. Define what this commitment entails in practical terms. For instance, specify whether partners are expected to:
    - Hold regular meetings with students to provide guidance and feedback.
    - Be responsible for supplying essential resources or materials needed for the project.

3.4 Supervisors

1. **Include Supervisors in All Project Phases.** Ensure that supervisors are actively involved throughout every phase of the project. This includes:
    - **Project Topic Creation**: Involve supervisors when defining and refining project topics to ensure alignment with academic standards and expectations.
    - **Meetings with Partners**: To provide continuity and oversight, have supervisors participate in or be informed about meetings with partners.

- **Thesis Writing**: Ensure that supervisors review and guide the thesis writing process to maintain academic quality and coherence.

2. **Establish Expectations for Supervisor Engagement**
   Discuss and agree with supervisors on their level of involvement, including whether regular meetings are required or if the student's needs determine the frequency. This agreement helps set clear expectations for supervisors and students regarding the support and guidance provided throughout the project.

3.5 Learning Objectives - knowledge, Skills and Competencies to be Developed by Students

1. Know how to apply the principles and techniques associated with designing and implementing real or simulated (project) cases.
2. Knowing how to apply and integrate the knowledge obtained in the AISS course units. How to develop work that integrates the knowledge acquired throughout the Master's curricular component.
3. Know how to investigate the state of the art in the object of study. The Project Work aims to carry out work applied to an organisation or business, aiming to solve a specific problem.
4. Generally, the interdisciplinary (project) course is intended to help students develop a theme of work that integrates the knowledge acquired over the other courses of the AISS master's degree.

References

Apostolellis, P., Taggart, J., and Schwartz, R. X. (2023). Creating effective project-based courses: personal relevance and its relations to successful group work. *European Journal of Engineering Education,* 48(6), 1165–1185. https://doi.org/10.1080/03043797.2023.2245772

Damsa, C., & Muukkonen, H. (2020). Conceptualising pedagogical designs for learning through object-oriented collaboration in higher education. *Research Papers in Education*, 35(1), 82-104.

García M. J. and Pérez M. J.E. (2017). Method to guide the design of project-based learning activities based on educational theories. *"International Journal of Engineering Education",* v. 33 (n. 3); pp. 984-999. ISSN 0949-149X.

Järvelä, S., Järvenoja, H., & Muukkonen, H. (2021). Motivation in collaborative inquiry environments. In *International Handbook of Inquiry and Learning* (pp. 157-173). Routledge.

Lakkala, M. (2010). *How to Design Educational Settings to Promote Collaborative inquiry: Pedagogical Infrastructures for Technology-enhanced Progressive Inquiry*. University of Helsinki Institute of Behavioural Sciences Studies in Psychology 66: 2010.

Larmer, J., Mergendoller, J., & Boss, S. (2015). *Setting the Standard for Project-based Learning.* ASCD. Alexandria VA. USA

Milo. (2023). *Designing an Effective PBL Curriculum: A Step-by-Step Guide for Teachers*. Notion4Teachers. *https://www.notion4teachers.com/blog/designing-an-effective-pbl-curriculum-a-step-by-step-guide-for-teachers*

Muukkonen, H., & Lakkala, M. (2009). Exploring metaskills of knowledge-creating inquiry in higher education. *International Journal of Computer-Supported Collaborative Learning*, 4, 187-211.

Muukkonen, H., Lakkala, M., & Hakkarainen, K. (2009). Technology-enhanced progressive inquiry in higher education. In *Encyclopedia of Information Science and Technology*, Second Edition (pp. 3714-3720). IGI Global.

Veza, I. and Mohd, M. S. (2023). *Implementing project-based learning: a practical guide*. Universiti Teknologi Petronas (UTP). The Times Higher Education. https://www.timeshighereducation.com/campus/implementing-projectbased-learning-practical-guide

Vesikivi, P., Bauters, M., & Holvikivi, J. (2021). Agile Methodologies in Learning with Design Thinking. *Technology Supported Active Learning: Student-Centered Approaches*, (pp 75-90). Springer.

Appendix 1. Examples of Easy-to-use Sources on Project-based Courses

1. Define the project by using, for example, these tips: Make sure that project objectives align with the educational goals of the course. Handle expectations – establish schedule, points of progress and final outcomes. Create clear assessment criteria for the outcome AND the entire project process.
2. Facilitate collaborative efforts and group work
3. Connect theory and practice in the project
4. Feedback and self-reflection

(Veza & Mohd, 2023).

Attempt to make the project somehow **personally relevant** to the students: For example, value and interest in specialisation correlate to expectancy, group connectedness, team cohesiveness, and perceived effort. It is recommended that students choose their own projects. (Apostolellis, et al, 2023)

Curriculum point of view: Designing a PBL Curriculum

Introduction: The Power of PBL

- Step 1: Selecting a Project Theme
- Step 2: Selecting Learning Goals
- Step 3: Designing the Project Structure
- Step 4: Developing Resources and materials
- Step 5: Implementing the PBL Curriculum

Effective Assessment Strategies for Project-Based Learning (PBL)

- Step 1: Rubrics
- Step 2: Self-Assessment
- Step 3: Presentations
- Step 4: Peer-reviews
- Step 5: Tests

Practical Tips for Facilitating Project-Based Learning (PBL) in the Classroom

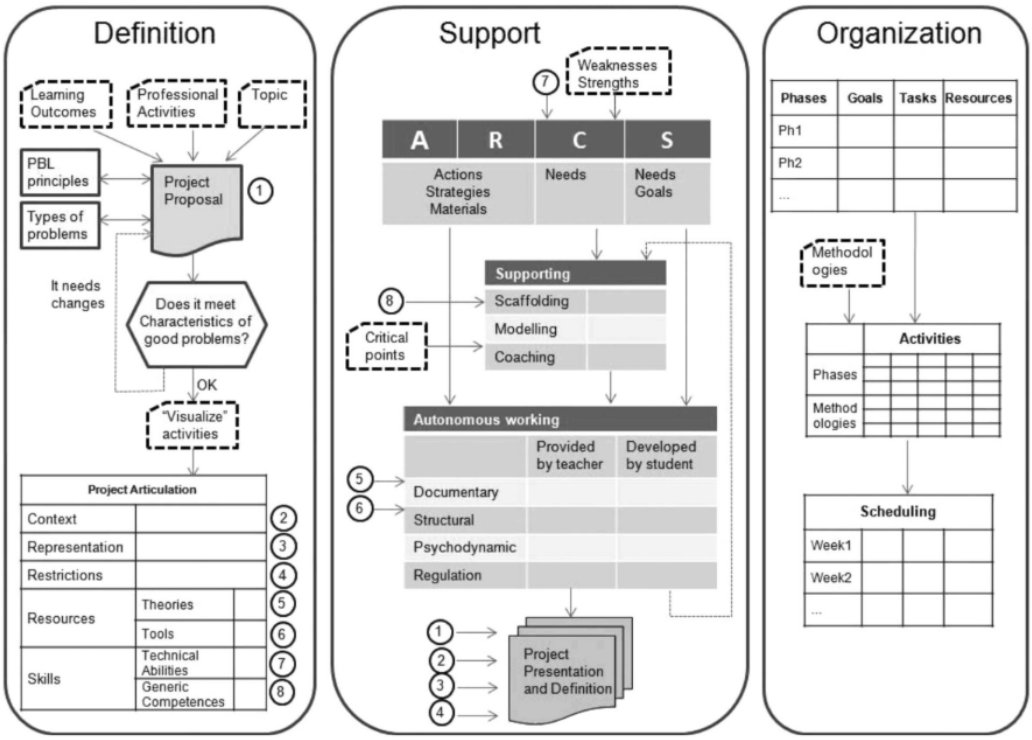
- Step 1: Foster Student Collaboration
- Step 2: Effective Time Management
- Step 3: Accommodate Different Learning Habits
- Step 4: Promote Reflection and Feedback
- Step 5: Encourage Real-World Application

(Milo. 2023, Notion4Teachers link)

Three phases: **Definition**, **Support**, **Organization**

"The goal of the first one is to elaborate on the definition of the project, follow the main PBL principles, and define the characteristics of good problems. This definition includes not only the goals but also other information that helps to articulate the project. Subsequently, the Support phase is devoted to

preparing different learning activities and materials to facilitate project success. Finally, Organisation phase assists in planning the teaching-learning activities throughout the semester". (García & Pérez, 2017).



"Using the method to design PBL activities seems to improve students' perception of course organisation and, to a lesser extent, of teacher performance."

"Yet, taking into account teachers' opinions, the method appears to be useful to help students overcome the main difficulties when they are facing complex and ill-structured projects. Teachers devote more attention to analysing the support needed by students to overcome these difficulties and improve their motivation." (García & Pérez, 2017).

In summary, the main points from multiple articles:

Definition of project
Support/Facilitation
Connection to specific course/material/theories
Self-assessment/Feedback

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