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HIGHER EDUCATION IN A DIGITAL ERA THROUGH PROJECT-BASED E-LEARNING

CONTRIBUTES OF THE RESTART4EDU PROJECT

Psicologia

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Higher Education in a Digital Era through Project-based E-learning

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Contents

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Introduction

Ângela Azevedo[a]
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Higher education has received increasing attention from researchers due to a marked growth and differentiation over the last forty years. Recent data (Eurydice, 2020) show that the student population in higher education is mostly female, except in Germany, Greece and Liechtenstein, and there is a higher number of men attending Bachelor's degrees, while women are attending Master's degrees. Considering this higher education institutions cannot be, therefore, indifferent to these changes in their student population. Although these changes, especially the exponential increase of students, are the result of an advance in terms of democratic educational policies, and search for lifelong learning opportunities that better prepare individuals for an unstable and competitive labor market (Hirschi, 2018). At the same time, they are associated with increased difficulties since higher education institutions have presented many difficulties in promoting a renewed and innovative teaching and learning process that should be focused on the students. These difficulties have been leading to consequences such as the increase of academic failure, particularly at the level of the academic

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transition year, change of course or academic dropping out (Azevedo & Faria, 2001).

The studies that have been dealing with these issues present a multivariate set of conditions associated both with the context of the study cycle (particularly related to the teaching process, the reception of students and, also, the pedagogical relationship) and with the psychosocial characteristics of young adults who have been undergoing changes in their developmental indicators, which translate into academic experiences, expectations, learning methods, social support network and academic preparation.

At the same time, the social, cultural, and environmental context has also undergone significant changes, affecting not only the type of course but also the professional skills that young adults should develop in their training process.

Also, in hindsight, we shouldn't forget that in higher education we find students with very different backgrounds, resulting from having attended very diversified courses in the previous studies cycle, sometimes more theoretical, sometimes more practical. These multiple aspects higher education population to be very heterogeneous, which makes it difficult to come up with adequate answers to their needs.

The successive reforms in the structure and type of educational offer before reaching higher education, particularly from the 1980s onwards, were not followed by an effective vision of the learning process, which focuses on an active student and on his or her autonomous learning characteristics, such as self-decision, self-learning and the close social relationships development. Adding to this, it has been observed that the university context, being less and less structured, demands a higher level of preparation that is not provided by secondary education, so the university student is forced to self-regulate his/her learning without, however, presenting adequate study habits, together with the gap between the knowledge acquired previously and that required by higher education (Faria & Lima Santos, 1998).

Thus, in higher education, the difficulties that students face throughout their academic journey are unavoidable, requiring a more personalized and personal follow-up by teachers which uses active and innovative learning methodologies. Currently, the cooperative and collaborative learning models are the basis of active methodologies, based on projects and information technologies that facilitate the development of technical and transversal scientific skills in students (Ferreira, et al, 2021; Loh & Ang, 2020). Having this in mind, the international policies

and the educational communities have been addressing the transversal competences that should be promoted in higher education, enabling young adults and adults to deal with global challenges, such as scientific and technological advances, societal asymmetries, socio-economic crisis and serious environmental problems. The list of this type of skills is variable, however, the most commonly mentioned skills in the literature are related to: information and communication technology, social, interpersonal, citizenship and learning-to-learn (Sá & Paixão, 2015).

Having said this, the current learning models, based on constructivist theories, have required changes on the higher education teacher. So, the higher education teacher in order to promote an active learning with discovery and problem solving (Almeida & Soares, 2002; Ferreira-Alves & Gonçalves, 2001), has to personalize the pedagogical relationship and needs to be constantly updating learning assisted by technologies and information. Similarly, they should reflect on their preparation and on how to work with students, assuming an encouraging attitude, adjustable to changing realities, using innovative methodologies that advocate collaborative work and project-based learning.

Innovation in higher education teaching calls for focus on students, whereby their psychosocial characteristics needs to be considered. Chickering and Reisser (1993) identified seven aspects of psychosocial development: sense of competence, emotional management, autonomy, satisfying interpersonal relationships and intimacy, identity, sense of life in a future perspective and creativity and integrity. Also, several studies carried out in different countries have shown that students, specifically in transition from hight school to higher education, develop important transformations, both in terms of intellectual skills and acquired knowledge, and in other fundamental areas in the construction of personal identity construction, such as attitudes, values, interests, aspirations, self-concept, self-esteem and interpersonal relationships (Abreu, et al, 1996).

Dias (2001/2002) summed these transformations up to three main psychological tasks that young people face at the end of adolescence: restructuring the relationship with theis parents at a more interpersonal level (by becoming more independent and developing a more egalitarian relationship) and at intrapsychic level (by building more realistic images of parents); construction of the identity and consolidation of the self, through the ability of projection into the future, consolidation of self-esteem, development of initiative, capacity to assume responsibilities and, internalization of personal values, among other aspects; estab-

lishment of stable love relationships, overcoming the fear of rejection, dependence and loss of autonomy, among other aspects.

Considering all these aspects, rethinking higher education implies a new approach to the learning process, to the role of the teacher and it should begin by looking at the current notion of young adult and of the competences he or she should develop in this cycle of studies. The use of active learning methodologies such as Project Based Learning (PBL) becomes mandatory. This handbook, organized under the project Restart for Education in a Digital Era through Project-based E-learning, funded by Erasmus Plus Programme (reference 2020-1-RO01-KA226-HE-095772), is intended to be a very useful working tool for higher education teachers, starting out by raising awareness of the need to use a new approach in this study cycle and ending with a deeper understanding of what Project Based Learning is.

To attain this purpose, this handbook is organized into three parts. In the first part, three theoretical chapters are presented which reflect on the concept of PBL and the underlying theories. In the first chapter entitled: entitled "A Literature and Practice Panoramic of Pre-Collegiate Education" begins by presenting, from a historical point of view, the "Learning to do" associated with the foundation of PBL. It also reflects a reflection on the networking in schools and its importance for active methodologies in the 21st century, such as PBL. It follows with a definition of PBL and its implication in higher education. The second chapter is entitled "Educational technologies to support learning and teaching: issues to consider", presents relevant issues related to teaching and learning. It reflects upon the dynamics between two processes: technology and pedagogy, namely how the use of technology can enhance pedagogy. At the same time, it presents learning and technologies from a theoretical perspective considering the most relevant models. It then focuses on the issue of the digital divide, meaning the obstacles to the use of digital technologies. It also reflects on the potential of Open Educational Resources (OER). The third chapter "Education in Higher Education in the era of performativity" presents the challenges of higher education in the context of educational transformations and European higher education institutions in the last decades. These challenges require a reflection on the specificity and autonomy of higher education institutions in terms of teaching, research, and service to society, as well as on the democratization of access to this level of education. This chapter, also, includes a reflection about the use of digital technologies in education as a catalyst for the changes needed after the pandemic period.

In the second part we present two chapters that represent two important steps in the implementation of a PBL course in higher education. The first one, "Project-Based Learning Experiences Devised by Combining Backward Educational Design and Design Thinking", authors explore educational design based on fusing together two techniques: backward design and design thinking, and its contributes in drawing student-centered learning experiences. The approach is used to illustrate the planning and the implementation of a project-based training course for university teaching staff interested in exploring the use of project-based learning (PBL) in their courses, providing some guidance for academics interested in drawing effective PBL units, emphasizing practical design aspects rather than theoretical aspects. In the second chapter "PBL in Higher Education: RESTART4EDU Proposal for Practice", authors try to present a step-by-step pathway to support higher education teachers drawing their first experiences with project-based learning supported by educational technologies. Integrating theory with hands-on examples, using very concrete examples, it helps less experienced teachers to venture into the challenge of drafting their first projects, based on literature and expert experiences that can be useful for planning and making the most thoughtful decisions possible.

In the third part of this handbook, a collection of papers that reflects academics experiences using PBL in their practice. Based on RESTART4EDU project, colleagues were invited to reflect about the implications of PBL in their teaching courses or research interests. The eight chapters presented in this part reflect the potentialities of PBL in several scientific areas, as medical and psychological Education, in social sciences and topics related to data. Other focused on the contributes of PBL to promote interdisciplinary teacher's experiences and focusing of integral human development. A third group of papers explored the application of PBL with vulnerable groups, particularly older adults, students with disabilities, and Roma people, but also to fostering refugee studies in higher education. And a final contribute intended to present a strategic analysis of PLB methodology using SWOT matrix. Despite diverse, contributes highlight the potentialities of this methodology to promote a richer and more challenging learning experiment, whether for students as for teachers.

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Part I

Higher Education Challenges

1

Project-Based Learning: A Literature and Practice Panoramic of Pre-Collegiate Education

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CHAPTER 1

Project-Based Learning: A Literature and Practice Panoramic of Pre-Collegiate Education

SUZIE BOSS [a]

Over the past two decades, project-based learning (PBL) has gained momentum in elementary and secondary education across the United States and in many other countries. With growth have come refinements in this instructional method. Researchers and practitioners have collaborated to define high-quality PBL, enabling teachers to adopt strategies for more effective project design, facilitation, and assessment. A number of factors contribute to the growing adoption of PBL in diverse settings, but chief among them is the promise of this instructional approach to prepare students for future challenges in college, careers, and active citizenship.

As more students experience PBL before reaching college, it's worth considering the implications of this trend for higher education. What are the characteristics and benefits of high-quality PBL? How well does PBL prepare students for the rigors of college-level academics? How might higher education best engage students who are accustomed to tackling real-world challenges and developing their sense of agency as learners? These are among the questions we will explore in this chapter.

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1. Building on Tradition

Learning by doing—the foundation of PBL—has a long history in education.

In ancient Greece, Socrates modeled learning through questioning, inquiry, and critical thinking—all strategies that remain relevant in today's PBL classrooms (Boss, 2011). In 16th century Italy, students of architecture and art applied their learning by creating scale models of churches and monuments. These assignments—known as *progetti*, or projects—required students to engage in active problem solving and to have their work evaluated by experts (Larmer, Mergendoller, & Boss, 2015).

John Dewey, the early 20th-century American educational theorist and philosopher, advocated for learning grounded in experience. Dewey challenged the traditional view of student as a passive recipient of knowledge and teacher as the transmitter of a static body of facts. He argued instead for active experiences that prepare students for ongoing learning about a dynamic world. Yet Dewey also emphasized the vital role of the teacher in creating the right context for experiential learning so that students would engage in thinking, sustained inquiry, and reflection (Larmer, Mergendoller, & Boss, 2015).

In previous decades, early childhood educators have played an important role in advocating for student-centered learning. Maria Montessori, Italian physician and child development expert, launched an international movement in the 20th century that continues to grow. She pioneered learning environments that foster capable, curious, adaptive citizens and problem solvers (Boss, 2011). Similarly, the municipal schools founded in Reggio Emilia, Italy, after World War II, have influenced early educators globally with their emphasis on curiosity, self-expression, and critical thinking over rote learning (Boss, 2017).

Pedagogies first introduced in graduate programs have also influenced the design of PBL for younger learners. Medical schools, for example, are credited with the development of problem-based learning, in which students apply their understanding of medicine by analyzing clinical cases. Disciplines including architecture, law, business, engineering, and social work regularly incorporate problem-based simulations and case studies (Mergendoller, Markham, Ravitz, & Larmer, 2006).

2. From Early Adopters to 21st Century Learning

Despite earlier waves of interest, by the late 20th century PBL tended to be driven by individual teachers or specialized schools. Without large-scale networks, a community of practice, or a common definition of PBL, these early adopters typically relied on their own creativity to generate project ideas and come up with strategies to manage student-centered learning. Although some projects succeeded brilliantly—particularly when it came to increasing student engagement—results were scattershot and documented primarily by anecdotes.

Some PBL advocates faced strong headwinds. The adoption of standardized assessments and high-stakes testing, especially in the U.S., meant an emphasis on content coverage over inquiry and memorization over problem solving. Achievement scores that focused primarily on math and reading left little instructional time or resources for interdisciplinary projects.

By the early 21st century, however, this narrow vision of student achievement was due for a reboot. Across diverse sectors, experts sounded the alarm that yesterday's focus on memorization and rote learning would not prepare students for a fast-changing, increasingly automated, information-saturated world (Boss, 2019). Adoption of educational technology gave students not only access to information but also tools to create their own content and share it with public audiences. The new century also ushered in demand for learning experiences that would prepare students for careers in STEM (science, technology, engineering, and math).

The Partnership for 21st Century Learning, comprising thought leaders from industry and academia, summarized the essential skills for the new century in a comprehensive framework (Battelle for Kids, 2019). The competencies considered key for learning and innovation and became widely known as the 4Cs: communication, collaboration, creativity, and critical thinking.

Could project-based learning offer a way to help students develop deep content understanding and also learn and practice these newly important success skills? The time was right for taking another look at PBL (Larmer, Mergendoller, & Boss, 2015).

3. Growing Networks

Current understanding of PBL in pre-collegiate education has been shaped in large part by networks of schools designed specifically to provide 21st century learning. Together, these independently organized networks include about 500 public schools and charter schools in the U.S., plus a handful internationally. Some networks were launched with industry partnerships, reflecting the concern that yesterday's schools would not produce a workforce ready for future challenges and opportunities.

School structures, assessment practices, and even bell schedules vary somewhat across different models, but PBL is the primary pedagogy in the New Tech Network, High Tech High, EL Education, and several other networks with similar visions. Some models emphasize internships, apprenticeships, or job shadows to connect students with careers. Collaboration with partners, clients, and experts from outside the classroom is common. Teachers in these settings typically leverage peer collaboration, team teaching, and, often, instructional coaching to improve their practice.

Individually, these networks have been transparent about their systemic approach to rethinking education through PBL. They open their classrooms to visitors, host conferences, and, in many cases, make project examples and resources publicly available. High Tech High, a network of K-12 schools in California, has established its own HTH Graduate School of Education to grow the pipeline of project-based teachers. [See Resources at the end of this chapter for information about project examples and supporting materials.]

In 2010, with funding from the William & Flora Hewlett Foundation, the Deeper Learning Community of Practice was established to promote cross-pollination across ten of these innovative networks, identify and scale best practices, and encourage research about effectiveness.

Across different contexts, schools in this larger network cultivate "a set of competencies students must master in order to develop a keen understanding of academic content and apply their knowledge to problems in the classroom and on the job" (William and Flora Hewlett Foundation, 2013, p. 1). Through these learning experiences, students develop six interconnected competencies considered to be prerequisites for college, career, and civic life (Huberman, Bitter, Anthony, & O'Day, 2014):

- Content expertise
- Critical thinking and problem solving
- Collaboration
- Effective communication
- Self-directed learning
- Academic mindset

Beyond the ten school networks that made up the original Deeper Learning community, PBL continues to gain traction in more traditional school systems, as well as in independent and international schools. Rather than using PBL as their primary method of instruction, however, teachers in these settings may introduce one or two projects per grading period, alternating with more traditional instruction. Unless PBL is core to school models, supportive structures such as teacher teaming, block scheduling, and embedded professional development may be lacking or limited.

Interest in PBL is also expanding globally, with initiatives to build teacher capacity underway on nearly every continent. In Chile, the Ministry of Education has promoted PBL with online resources, conferences, and publications. In China, schools focused on STEM education are providing teachers with professional development about PBL as a core pedagogy. Colombia and Australia have also been hosts to PBL conferences and exhibitions of student project work. China hosts an annual Deeper Learning Conference. To varying degrees, international schools in India, Pakistan, Singapore, and Europe have also supported professional development focused on PBL methodology.

4. Defining What's Essential

Whether students engage in projects all the time or only occasionally, it's important for their learning experiences to be of high quality. If not, projects can result in ineffective use of learning time or uneven outcomes for students. More than a century ago, John Dewey cautioned against poorly conceived learning experiences that would lead students to "muddle and mess" (Dewey, 1916, p. 205).

An early research review cautioned that the variety of practices under the banner of PBL makes it difficult to assess what is and what

is not project-based learning (Thomas, 2000). A lack of consensus about how to design, implement, and assess PBL can lead to uneven outcomes "with varying degrees of academic rigor, curriculum materials derived from competing design principles, and a consequently uneven evidence base for PBL effectiveness" (Baines & DeBarger, 2015, p. 2).

To build common understanding of high-quality PBL, the Buck Institute for Education (a U.S.-based nonprofit later renamed PBLWorks) introduced a framework in 2013 for Gold Standard Project Based Learning. Based on research and practice, the framework provides "a description of what PBL looks like when it is done really well—a North Star to shoot for and approach through problem solving, practice, and reflection" (Larmer, Mergendoller, & Boss, 2015, p. 34).

The Gold Standard identifies seven Essential Project Design Elements that enable students to reach key learning goals. These learning goals are intentionally defined as both academic (content knowledge and understanding) and non-academic success skills (such as critical thinking, collaboration, and self-management).

Based on the Gold Standard, elements that teachers should keep in mind as they design and implement projects include (PBLWorks, n.d.):

- **Challenging problem or question:** A challenge or open-ended driving question frames the project. For example: How can we reduce our school's carbon footprint? How can we tell the unknown stories about our community's history? How can we spread awareness of mental health services?
- **Sustained inquiry:** Students ask questions, investigate, and conduct research to make meaning. In the process, they deepen information literacy skills and think critically about the reliability of sources.
- **Authenticity:** Real-world context for problem solving adds relevance; students engage in tasks and use tools employed by experts.
- **Student voice and choice:** Students make decisions and express themselves; although guided by their teacher, they are not simply following instructions or predetermined steps.
- **Reflection:** Students reflect on their learning throughout the project, recognizing struggles as well as breakthroughs.
- **Critique and revision:** Students improve their work by giving and receiving feedback, often producing multiple drafts of products.
- **Public product:** Students apply their learning to create a final product or solution, which they share with an audience beyond the classroom.

Although all seven elements contribute to successful learning experiences, it's important for teachers to remember that the framework is designed to be flexible. The degree of student voice or authenticity can vary widely from one project to the next. The choice of final product is also variable. In some projects, all students contribute to the same public product, such as making a video documentary. In others, students determine how they want to provide evidence of their learning; some might develop a physical product or prototype to solve a problem while others might make a presentation, backed by evidence, to sway decision makers.

In an economics project, high school students in Zurich, Switzerland, focused on problems that related to the United Nations Sustainable Development Goals. Applying economic theory, different teams devised a wide range of solutions. One team worked with a nonprofit partner to improve supply chains in the developing world for inexpensive products that remove pollutants from drinking water. Another used data analysis to convince the school governing board to invest in carbon offsets. Despite their different areas of focus and final products, all students mastered the same concepts about economics.

As project designers, teachers must decide how open-ended or limited student choices will be, based on factors such as time, resources, and students' age and prior experience with projects. They also decide whether learning goals will focus on a single content area or expand to interdisciplinary learning.

At Gimnasio Los Caobos, an independent school in Bogotá, Colombia, schoolwide adoption of PBL has set the stage for learning that extends across grade levels and content areas. At a recent exhibition, middle school students shared their research-based design for a large orchard that will provide fruits and vegetables for a nearby community that lacks access to fresh, affordable food. To develop their design, they conducted surveys, created maps, analyzed economic data, learned about plant biology, and collaborated with external partners. Meanwhile, high school students in a computer science class focused on designing an automated irrigation system for the same orchard, using 3-D modeling to produce prototypes.

In addition to the Gold Standard, other PBL frameworks have emerged that clarify considerations for students, teachers, and researchers. The Framework for High-Quality PBL, introduced in 2018 and developed through collaboration with hundreds of PBL educators and thought leaders, describes PBL from the student's perspective. For

PBL to be of high quality, according to this framework, students should experience all of the following, at least to some degree (hqpbl.org):

- Intellectual challenge and accomplishment, leading students to learn deeply, think critically, and strive for excellence;
- Authenticity, through projects that students find meaningful and relevant;
- Public product, with student work publicly displayed, discussed, and critiqued;
- Collaboration, both with other students and with adult mentors and experts;
- Project management, including processes for managing time and tasks;
- Reflection, which happens throughout the project.

Design principles for rigorous PBL inform the work of Lucas Education Research, which invests in independent research to build the evidence base for PBL. LER defines rigorous PBL as learning that is purposeful and authentic, driven by a focus on and the integration of course content, enhanced by meaningful and supportive interactions, and implemented using evidence-informed teaching and assessment practices (Baines et al., 2021).

Across these frameworks, a defining characteristic of high-quality PBL is that projects form the centerpiece of the curriculum; they are not an add-on or extra at the end of a traditional unit of instruction (Thomas, 2000; Boss & Krauss, 2018; Baines et al., 2021). This requires a shift in thinking for many adults whose own experiences with projects may have been limited to hands-on activities that followed more serious learning. Such activities, while not without value, tend to lack the academic challenge, inquiry, student voice, and public product that are core to PBL.

Consider the difference between two learning experiences. In the first example, elementary students learn about habitats from studying their textbooks and taking part in classroom activities planned by their teacher. At the end of the unit, after a test on content, each student is assigned to make a shoebox diorama of a different habitat. Results are then displayed around the classroom.

In the second example, elementary students watch a news broadcast about new funding to expand the city zoo. They then video-conference with zoo staff, who invite them to submit proposals for new

animal exhibits that will interest young visitors and support the zoo's mission of protecting endangered species. Next, their teacher facilitates an active discussion in which students pose questions they want to research before making their proposals. An investigation phase follows, with students taking part in a variety of learning activities (facilitated by the teacher) to build their background knowledge about habitats, endangered species, and the design process. After brainstorming potential ideas for proposals, students form small teams around shared interests. They consult with experts in exhibit design, animal science, and environmental education as they begin to generate concepts for their own proposals and make improvements. Finally, teams present their diverse ideas to zoo staff using a variety of modeling techniques (such as 3-D printing, blueprints, and slideshows) to make their pitches.

In both examples, students learn similar content about science. The first example, however, lacks an authentic purpose. There is little opportunity for student choice or inquiry, and no audience beyond the classroom. In the second example, students have an immediate "hook" for their curiosity when their input is requested by an authentic audience. That makes learning more purposeful and raises the stakes for producing work of high quality. Learning goals extend beyond content mastery to include communication and collaboration skills.

Although technology integration is not specifically addressed in the Gold Standard or other frameworks, students often use digital tools as part of PBL. For teachers, the challenge is to integrate technology purposefully. Digital tools alone do not transform traditional units to PBL. When integrated with a focus on learning goals, however, technology can enable students to access primary source material, conduct surveys, analyze data, connect with experts and partners, produce 3-D prototypes or videos, take virtual field trips, and much more. In PBL, students use digital tools much as professionals do—to communicate, collaborate, investigate, create, and share their work with authentic audiences. When integrated as part of effective project design, technology can take learners places they could not otherwise go (Boss & Krauss, 2018).

Middle school students from Canada, for example, became global microlenders in a project that addressed geography and economics content. Using an online platform (Kiva.org), they researched requests for funding from small-scale entrepreneurs in the developing world. Before choosing how to invest funds that they had raised through their own entrepreneurship projects, students analyzed the standard of living

in different regions, learned to calculate interest rates, and reviewed the business plans of individual borrowers. They also applied their social media skills to raise awareness of how young people can contribute to the United Nations Sustainable Development Goals through global learning experiences. Technology was an important tool in the project, but not the main focus of learning.

5. Evaluating Effectiveness, Documenting Challenges

Recent years have seen an increase in research about the effectiveness of project-based learning. Earlier findings documented increased student engagement and motivation in PBL—important foundations for learning (Blumefeld et al.; 1991; Brophy, 2013). More recent studies have examined whether PBL improves academic outcomes, builds non-academic success skills, and contributes to social and emotional learning.

Four peer-reviewed studies conducted in U.S. public schools show that rigorous PBL has a strong, positive impact on student outcomes across grade levels and content areas. These results were achieved in diverse districts with large percentages of traditionally underserved students, indicating the potential of PBL to improve equity (Lucas Education Research, 2021).

Key findings include:

- Adding rigorous PBL to Advanced Placement courses in high school improved student achievement on AP exams (Saavedra et al., 2021).
- Elementary students improved in science and areas of social and emotional learning with a project-based approach (Krajcik, 2021).
- Early elementary students using PBL made more progress in social studies and informational reading than peers in more traditional classrooms (Duke et al., 2020).
- Middle-school students outperformed their peers in science and other core subjects and improved in groupwork when using PBL. English language learners in the PBL classrooms also did better than a comparison group on a language proficiency test (Deutscher, 2021).

These findings echo research showing the effectiveness of PBL to boost achievement as well as problem-solving skills in specific content areas, including high school economics and social studies (Finkelstein

et al., 2010; Maxwell, Mergendoller, & Bellisimo, 2005). Among younger learners, PBL shows benefits for increasing student outcomes in social studies and literacy (Duke, Halvorsen, & Strachan, 2016; Duke et al., 2020).

Despite these positive results, PBL is not without challenges. Researchers have found PBL to be of limited use for building basic knowledge and skills (Hattie, 2009; McDowell, 2017). In *Rigorous PBL by Design*, Michael McDowell (2017, p. 23-26), cautions against two potential pitfalls of PBL: (1) "scratching the surface," in which students may be engaged by the context of a project but fail to make substantive growth in learning; and (2) "missing the mark," in which students spend considerable time on process skills (such as finishing assigned tasks or fine-tuning the aesthetics of products) rather than learning important content and closing cognitive gaps.

For many teachers, PBL is still an unfamiliar pedagogy. They may struggle to design projects that align with rigorous learning goals. Some teachers lack experience with formative assessment strategies that let them know where students are in their understanding relative to learning intentions of the project (McDowell, 2017). To take on the role of facilitator rather than classroom expert, teachers may need professional development to help them expand their strategies to manage student learning. It's no accident that all of the PBL studies funded by Lucas Education Research have included professional development as part of their experimental design.

School structures can also be impediments to PBL. Large class sizes, limited opportunities for teacher collaboration or professional development, and inadequate access to technology and other resources can all pose challenges to implementation. Narrowly organized content silos can inhibit the design of interdisciplinary projects in high-interest areas such as sustainability, invention, entrepreneurship, and civic engagement (Kay & Boss, 2021).

The culture of schools is another factor that can limit the success of PBL. If teachers are expected to follow a tightly scripted curriculum, that leaves little opportunity to design projects around students' interests. Similarly, an emphasis on high-stakes testing can pressure teachers to focus on content coverage rather than application of knowledge. A change in leadership can also derail PBL implementation if the new leader has a different agenda. Parents, too, can be critical of PBL if they do not understand potential benefits for their children.

Systemic challenges to PBL adoption surfaced in the United Kingdom, leading to the conclusion that "PBL is really hard to do well… Schools embarking on the introduction of new practices need both strong leadership and the capacity to manage significant change which, in the case of PBL, means altering the curriculum, pedagogy, timetables, staffing structures, professional development and leadership structures. Or, it means designing a new school from scratch, which is an opportunity available only to some" (Innovation Unit, 2016).

Despite these challenges, the pressure to prepare students for future challenges remains high. The World Economic Forum predicts that the skills most in demand by employers in 2025 will include analytical thinking and innovation, complex problem solving, critical thinking and analysis, creativity and initiative (World Economic Forum, 2020). PBL has the potential to develop all these competencies. Yet a recent international comparison found a persistent scarcity of pedagogies to develop and assess students' 21st century competencies (Taylor, Fadel, Kim, & Care, 2020).

6. Implications for Higher Education

What might the future implementation of high-quality PBL mean for college-bound students?

Results from schools that use PBL as their core instructional strategy offer some insights about how well a project-based education prepares students for the academic rigor of college. These schools report higher graduation rates, better test scores, and stronger interpersonal skills compared to more traditional schools (Zeiser et al., 2014). Research is lacking about students who have only limited experiences with PBL.

Students attending schools in the New Tech Network, one of the PBL models, outperform students from non-New Tech schools in academic measures (including college placement exams and state assessments). In addition, they make statistically significant gains in critical thinking and demonstrate college and career readiness skills. College persistence rates among alumni exceed the national average in the U.S. (New Tech Network, n.d.).

Similarly, High Tech High, serving a socioeconomically diverse population including many students who will be the first in their families

to attend college, promotes what it describes as a college-going culture, with 96 percent of graduates attending college (Rosenstock, 2019).

When students with a strong PBL background apply for college, they can draw on a wide range of learning experiences to introduce themselves to admissions officers. High Tech High students, for example, create digital portfolios that include work samples from class projects, personal statements, and reflections on their learning gained in internships and job shadows. Students from Envision Learning schools, another PBL network, build portfolios throughout high school and defend their work before a panel of experts before graduation. As a result, they become adept at reflecting on their strengths, challenges, and accomplishments.

Similarly, in schools that have adopted the Mastery Transcript, students create a holistic picture of their learning. By reflecting on learning gained from projects, community service, internships, and extracurricular activities, students present a more personalized portrait than what can be communicated with grade-point averages or class rankings. Adoption of the Mastery Transcript continues to expand from independent schools to public schools, both in the U.S. and internationally.

Because PBL emphasizes success skills along with academic mastery, students who have had extensive project experiences should, in theory, arrive at college ready to collaborate effectively, think critically, and manage their own learning. Comfortable with peer learning, these students are likely to form study groups and to advocate for the help they need as learners. The cycles of feedback and revision that are embedded in high-quality PBL foster a growth mindset, giving students courage to take academic risks and to learn from setbacks (Boss & Krauss, 2018; McDowell, 2017).

There is no one profile of a typical PBL student, of course. But by definition, high-quality PBL engages students in authentic challenges, develops their capacity to inquire, and connects them with the world beyond the classroom. Before starting college, these students may have advocated for the passage of legislation to reduce gun violence, partnered with scientists to address environmental pollution, improved access to affordable food in food deserts, or led anti-bullying campaigns on social media. The desire to engage in complex, real-world issues—to not only learn deeply but to apply their understanding—is not likely to fade once these students enter higher education.

Resources

The following resources provide examples of high-quality project-based learning along with tools to support PBL implementation in K-12 education.

Changing the Subject (https://www.changingthesubject.us/the-book.html): This digital publication includes descriptions, artifacts, and reflections from twenty years of projects at High Tech High. Because most examples combine multiple disciplines and can be adopted across grade levels, they are organized in three broad themes—Invention and Reinvention; In the World, With the World; With Each Other—reflecting the way students use their learning to make change.

Edutopia (www.edutopia.org), an online publication of the George Lucas Education Foundation, includes video case studies of projects from the U.S. as well as internationally, along with research highlights and strategies for project implementation.

Models of Excellence (https://modelsofexcellence.eleducation.org/), created in collaboration with Harvard Graduate School of Education and hosted by EL Education, is an open resource featuring exemplary project from grades preK-12. Projects are searchable by content area and grade level.

PBLWorks (www.pblworks.org/) is a nonprofit organization based in the United States that promotes high-quality PBL as a strategy to advance educational equity and empower youth furthest from opportunity. Online resources include an extensive project library, tools for project planning and assessment, and video case studies of Gold Standard PBL.

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2

Educational Technologies to Support Learning and Teaching: Issues to Consider

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CHAPTER 2

Educational Technologies to Support Learning and Teaching: Issues to Consider

PALITHA EDIRISINGHA[a]

1. Introduction

Technology is increasingly becoming an integral part of our lives. They are tools to support and improve human activity. They have the potential to help us do things more efficiently and in new ways that we haven't seen before. This has never been true during the uncertain times that we have experienced during the Covid-19 pandemic. We all have personal experiences of how much we have relied on technologies during those difficult, lock down days to learn, to socialise, to keep in touch with family and friends, to buy our groceries and other essential (and non-essential!) goods, to keep fit, and for many more things.

This chapter focuses on the use of technologies for the purpose of education. Your experience with technologies prior to and during the Covid-19 pandemic, especially for learning and teaching would be a very useful source for you to tap into as you read this chapter.

The chapter provides an overview of some of the selected issues relevant to supporting teaching and learning. We will first investigate the synergy between technology and pedagogy in order to make sense of how we might use technologies in pedagogically useful ways. Here we look at learning and technologies from a theoretical perspective, and models of learning before mapping learning technologies on to how we

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learn. The next section focuses on the issue of digital divide, an issue for at least some of our learners and sections of the society. The third section of the chapter offers a discussion of the potential of Open Educational Resources (OERs) that have the potential to improve access to high quality educational material for our teachers and learners. The chapter ends with a set of concluding remarks and reflections.

2. Pedagogy and Technology: towards a synergy

What should be our starting point when we plan to use technologies for teaching and supporting students' learning? Are we going to start with technology? Or should we start with an understanding of what learning is, or how people learn? Or are there other issues to consider?

It is important to think about a constructive relationship between technology and pedagogy. We could think about this synergy in terms of several layers: learning theories, frameworks to organise teaching and learning activities, and technologies. If we are to make the best use of technologies, it is important to consider the relationship between learning theories (including models and frameworks) and technologies to support learning. Technology and pedagogy need to walk in lockstep. We cannot think about technology in isolation of underlying principles that promote learning (pedagogy). We will try to answer the question: how we might incorporate technologies in a more pedagogically sound way, rather than considering technologies as our starting point.

Figure 1. The relationship between theories, models of learning and technologies.

2.1 Learning and technology: theoretical perspective

The diagram below (Figure 1) represents one approach to thinking about the link or the relationship between learning theories, models of Learning / pedagogical frameworks and learning technology. We look at each layer of the diagram in turn.

The diagram presents learning theories as the foundation for implementing technologies to support learning activities. A quick note before we proceed: we understand that all the technologies that you might be able to recognise in the diagram are either those that we are familiar or have origins in the West. Therefore, the diagram is incomplete; it doesn't include equivalent technologies that are available, for example, in East Asian countries. You might want to make this diagram complete by adding the varieties of technologies that you are familiar with and / or

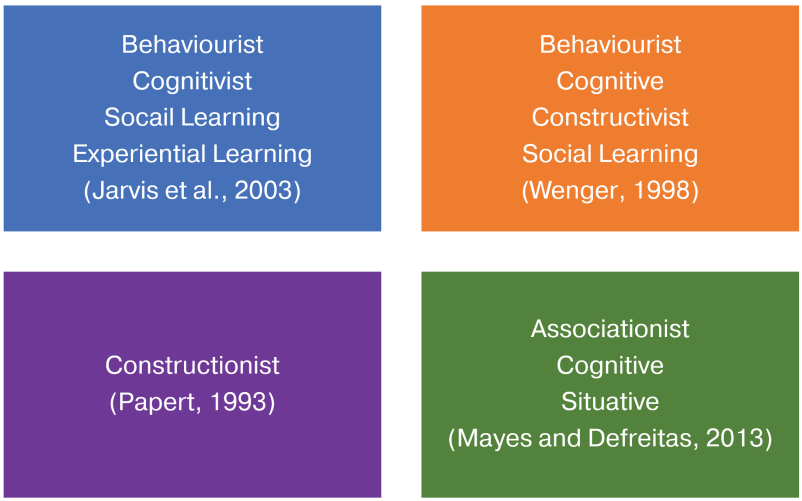

Figure 2. An approach to categorising learning theories.

available in your own geographical context.

Let's start with learning theories or theoretical perspectives of learning – the foundational layer of the diagram. Different authors tend to categorise learning theories in different ways. Figure 2 is an attempt to categorise some of these learning theories. As there are many different ways of looking at learning from a theoretical perspective, It would

be useful to read several authors to refresh your thinking on learning theories.

Starting from the top left of the diagram above, Peter Jarvis and his colleagues (2003) discussed learning theories according to four categories: behaviourist, cognitivist, social learning, and experiential learning. Wenger (1998) discussed similar categories of learning theories but added constructivist learning theories. Seymour Papert (1993) (https://en.wikipedia.org/wiki/Seymour_Papert) in early 1990 came up with the idea of constructionism. Papert's ideas of using computers with children were revolutionary in the 80s and 90s. He wrote persuasively about constructionism in his 1993 book *Mindstorms: Children, Computers, ad Powerful Ideas*. He challenged the conventional views of using computers to teach children and asked what if the child teaches the computer, ie., programming the computer, rather than the computer teaches the child. In developing the theory of constructionism, Papert built on Piaget's idea of constructivism. You might be familiar with at least two perspectives of constructivism: cognitive constructivism (involving mainly individual efforts) and social constructivism (learning with social connections). Based on the theory of constructionism, Papert developed a computer programme called *Logo*, meaning 'word or thought' in Greek (https://en.wikipedia.org/wiki/Logo_(programming_language). This was meant for children's active involvement in their learning process. Here the child is driving learning.

One of the more recent initiatives based on the constructionist approach to learning is the Raspberry Pie computer initiative. The following URLs take you to useful websites about the Raspberry Pie computer initiative and its link to Seymour Papert's ideas of constructionism. These resources would be useful to develop ideas and approaches to support active learning.

- https://www.raspberrypi.org
- https://www.raspberrypi.org/blog/research-seminar-mathematics-programming-links/

The last section of the diagram above (Figure 2) shows Mayes and de Freitas's (2013) contribution to thinking about perspectives of leaning theories. They came up with another way of categorising learning theories, proposing three perspectives of looking at learning theories: associationist, cognitive and situative. The *associationist* perspective considers "learning as the gradual building of patterns of associations

and skill components" through a process of "connecting the elementary mental or behavioural units, through sequences of activity followed by feedback of some kind" (*ibid*, p. 19). This perspective builds on learning theories linked to associationism, behaviourism and connectionism. The second perspective – *cognitive* – draws on research on memory, psychological approaches to learning, and constructivism; learning is achieved "through an active process of creating hypothesis and building new forms of understanding through activity" (*ibid*, p. 21). In contrast to these two ways of looking at learning, the *situative* perspective focuses on the social dimensions of learning. It considers "all learning as situated" and "A learner will always be subject to influences from the social and cultural settings in which the leaning occurs… ." (*ibid*, 22).

Having looked at a number of approaches to conceptualise how learning occurs from a theoretical perspective, now the question is, how might we put learning theories into practical action of using technologies to support learning. While we can agree on broader perspectives of learning theories, a challenge is to put theory (eg., constructivist perspectives of learning) into practice and using technologies for our learners to engage in active forms of learning. Very often learning can be teacher-centred, and then students will be learning in isolation using books and computers. We need to transform theoretical ideas, eg., constructivism, into meaningful teaching and learning activities which then guides us the choices of technology.

The middle layer of the diagram (Figure 1) – models of learning – could provide a helpful bridge between learning theories and learning technologies. We will look at three specific frameworks in the remainder of this section.

2.2 Models and frameworks to design learning activities

2.2.1 From participation to contribution

The first of these models consider participation in learning as a continuum of activities (Figure 3). Sfard (1998) proposed two ways of categorising learning activities: acquisition-oriented, and participation-oriented learning activities.

Engaging in 'acquisition-oriented' activity is something like learning by reading a book (as you are doing now) or a webpage, by listening to a podcast, or by watching a video or television programme. Importantly, Sfard drew our attention to focusing on 'participation-oriented' activ-

Figure 3. Participation in learning – a continuum of activities.

ities (the middle of the diagram). So this is where you as a teacher might create some activities, eg., using project-based learning approaches, so that your students can get involved in active learning. When we try to do breakout rooms Zoom or Microsoft Teams (or any other platform), we might be trying out some participation-oriented activities. So, according to Sfard's framework, these are the two main ways of thinking about teaching and learning.

Two other researchers – Collis and Moonen (2001) – added what they thought as something missing from these categories of learning activities. They came up with the idea of 'contribution-oriented' activities, i.e., activities that the students are doing, actively, to contribute to the learning process. So that means students not only take part ('participation-oriented' activities), but they can make 'contributions' to the learning process as well. Participation oriented activities can be passive, but contribution-oriented activities, take this a little further, asking students to create something and contribute. Project-based learning approaches have plenty to offer in terThe authors (Collis and Moonen, 2006) have developed the concept of 'the contributing student' and developed a pedagogical model which they named as 'contribution' model.

2.2.2 Laurillard's Conversational Framework

Pedagogical frameworks developed by Laurillard during the last three decades are some of the most influential theoretical frameworks that we can use to think about how we use technologies to support learning activities. Two of her contributions that we consider in this section are the **Conversational Framework** (Laurillard, 1993, 2002, 2012) and **6 types of learning** (Laurillard, 2012). Laurillard developed the first version of the Conversational Framework in 1993, which she has refined in her subsequent works in 2002 and 2012. These developments reflect the emerging landscape of digital technologies and recent scholarly work and focus on designing for learning. Based on these frameworks, Laurillard and her colleagues in University College London in the UK have created a learning design approach called ABC framework (https://abc-ld.org/) which has become widely recognised as an effective approach to developing courses for active learning.

Laurillard (2012, p. 93) acknowledges that her Conversational Framework is somewhat complex, but it is: *'the simplest possible static visual representation that can capture the complexity of the collective ideas in the literature on what it takes to learn, and therefore what it takes to teach."* The conversational framework is based on an analysis of learning underpinned by several theoretical perspectives including conceptual learning, experiential learning, social constructivism, constructivism, and collaborative learning. This also takes into consideration principles of learning and instructional design.

In her Framework, Laurillard (2012) characterises the teaching and learning process as a dialogue between the teacher and the learner. The teacher and the learner need to engage in this dialogue to arrive at the understanding of the aspect of the world that is in question. Conversational Framework depicts this interactive, dialogic, and active learning and process that need to occur in a teaching-learning context. Figure 4 is a simplified version of the Conversational Framework.

At the core of this framework are the teacher and the learner. If learning is to happen and depending on the nature and the level of academic content (i.e., introductory, advance), the teacher and the learner must engage in activities at several levels.

First, there are several teacher-learner interactions at the **conceptual** level as shown at the top of the model. Here the teacher explains the topic at the conceptual level and the student must have chances to describe and re-describe their understanding. It is very

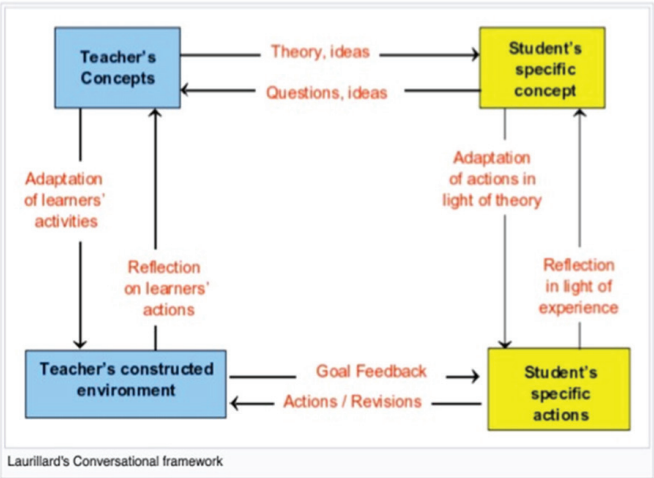

Figure 4. The Conversational Framework (a simplified version).
(Source: https://edutechwiki.unige.ch/en/Laurillard_conversational_framework).

important that there are opportunities for this sort of interaction in a teaching-learning context.

Second, depending on the nature of the subject matter, the teacher must set some **activities** for the student to carryout in real world, in a laboratory or in a simulated world (eg., on computer and internet) where the student can engage in active learning to understand the topic in question. The space here is limited to explain how the conversational framework operates in practice, but the 2002 book and the 1993 book explain this elegantly. If you are pressed for time, pages 81 – 90 of Laurillard's 2002 book are also helpful to gain an understanding of the Conversational Framework!

The following link will take you to a helpful video and a short description that explains the Conversational Framework.

- https://www.futurelearn.com/info/courses/blended-and-online-learning-design/0/steps/191671

Using Conversational Framework as the basis to analyse teaching-learning interaction, Laurillard proposed an approach to identifying and analysing learning activities (Table 1) that can be considered effective in promoting active learning. In the early version of the Conversational

Framework (1993, pp. 94 – 95)) Laurillard identified four functions that the teacher and learner need to perform for effective learning. She then extended these (in her 2012 book) to include functions that include some element of producing artefacts, depending on the topic of study. But for the purpose of this chapter, we start with her first conceptualisation of the four types of learning activities: **discursive, adaptive, interactive**, and **reflective**.

Discursive	▸ Teacher's and learner's conceptions should each be accessible to the other ▸ Teacher and learner must agree learning goals for the topic, and task goal ▸ The teacher must provide an environment within which the learner can act on, generate, and receive feedback on descriptions appropriate to the topic goal
Adaptive	▸ The teacher needs to assess the similarities and differences between his/her own conception and the learner's conception to determine the focus of the continuing dialogue
Interactive	▸ The learner must act to achieve the task goal ▸ The teacher must provide meaningful intrinsic feedback on the actions that relate to the nature of the task goal
Reflective	▸ The teacher must support the process in which the learner links the feedback on his or her actions to topic goal for every level of description within the topic structure

Table 1: Teaching and learning functions (Laurillard, 1993)

Learning activities that can fulfil the above four functions could be considered effective. To begin with, there should be a dialogue (**discursive** activities) between the teacher and the learner. In this dialogue the teacher and the student express their conceptions, aiming to understand each other's conception. Based on the outcome of the discussion, the teacher adapts (**adaptive**) the learning task for the learner.

The third function, interaction (**interactive**), allows the student to experience the world, or the aspect of the world that the learner is trying to understand or learn. Here the teacher's responsibility is to create opportunities for the student to experience this world. Laurillard calls these 'teacher-constructed worlds', either in the real world or on

computer. Some examples of these 'teacher-constructed worlds' are classroom experiments, field trips, poems, depending on the subject matter. The teacher constructs the conditions for the learner's interactions so that the experience enables to learners to learn. Based on that particular experience the teacher can then begin to build general, abstracted descriptions.

The **reflective** function should be carried out by both the teacher and the learner. The teacher reflects on the learner's performance and adapts what s/he says accordingly, as mentioned earlier. This is to make teaching responsive to the learner's needs. The student uses what the teacher says to adapt his or her actions., and to reflect on the results of these actions in the teacher-constructed world, to modify and develop his or her own ideas, until both the teacher and the learner come to the same understanding.

Laurillard considers how various technologies can take the teacher's role and perform the above four functions. She points out that it is *far easier to provide activities of the discursive function than the adaptive, interactive and reflective functions*. Audio and visual media such as podcasts, videos, and narrated presentations can convey the teacher's conceptions, but this is only one activity within the discursive stage. Quite often, we (as teachers) tend not to engage the full range of discursive functions and not to engage in other three categories of functions. Laurillard points out that enabling the learner to carry out activities in the adaptive, interactive, and reflective stages are crucial for learning. They can facilitate and promote active learning. How might we achieve this? We need to think about a typology of learning activities.

2.2.3 Laurillard's Six learning Types

Building on the Conversational Framework, Laurillard categorised learning activities into six types (Figure 5). These categories of learning types have been used in developing a learning design approach called ABC Learning Design (https://abc-ld.org/ning).

Lets looks at a couple of types of learning activities that Laurillard has categorised in the figure above. Examples of learning by acquisition involve activities such as listening to a lecture (online or in a physical classroom), reading articles and books (on print, online).

In contrast, learning by practice involves learners 'actively' carrying out some tasks 'in practice' in real world or on a computer-based simulated world. In the video accessible from the link (https://www.youtube.

Figure 5. Six type of learning activities (Laurillard, 2012).

com/watch?v=TSP2YlgTldc) Laurillard explains the six types of learning activities with examples of associated learning technologies. Laurillard says: "Together, all six types of learning activity cover most of what you're ever likely to ask a student."

2.3 Technologies to support learning activities

So far we have reviewed the two foundational layers for use to build on to support the use of educational technologies for successful and active learning activities: theories of learning and models or frameworks to support learning. We then turn to technologies themselves. Figure 6 (from Laurillard. 2012, p. 96) is an attempt to map learning technologies, both conventional and digital, on to different types of learning activities.

Are there any other ways or approaches that you might use for categorising your learning and teaching activities that might be useful

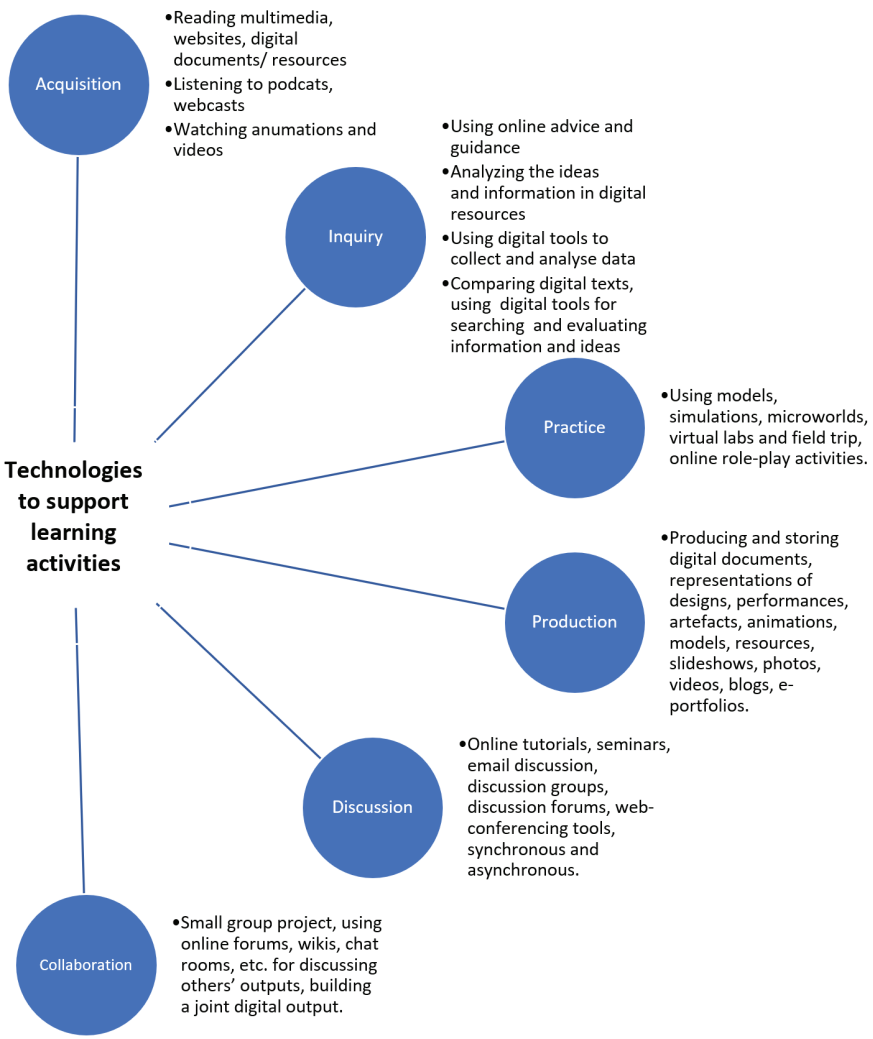

Figure 6. Types of learning and the difference types of conventional and digital learning technologies that serve them (from Laurillard, 2012, p. 96).

for you to map various technologies (eg., freely available Apps) on to those activities?

3. Barriers to using digital technologies: digital divide

While there is a good rationale for using learning technologies to support learning, we also need to consider some of the challenges associated with using technologies to support learning. In this section we consider the issue of digital divide. The Covid-19 pandemic has shone a light on the issue of access to the internet and digital devices not only in economically less developed parts of the world but also in communities in more developed countries.

We are going to consider the questions: What do we mean by the digital divide? Why is it important to discuss it? Can we afford to ignore the digital divide? What are the implications of the digital divide for learning in different educational contexts (age groups, learning settings, geopolitical settings)? And we will look at ways of addressing the problem of the digital divide to improve education and to increase access to it.

In this section we consider definitions of digital divide, before looking at the extent to which attempts to close the digital divide have been successful. We will then look at the different types of access to technology, which might help us to understand how the digital divide occurs before moving to the next section on digital literacy skills. It would be useful to reflect on our recent experience of digital divide: Did the pandemic shined a light on hidden digital divides in our communities?

Van Dijk (2005, 2020) provides an overview of the concept of 'the Digital Divide' and its implications for learning at all levels of education. His two seminal works published 15 years apart charts the changes in the way we developed our understanding of this important concept. As Van Dijk (2020) writes in the introduction to the 2020 book, 'In the year 2020 both the concept of and the research into the term digital divide [is] 25 years old' (van Dijk, 2020, p. 1). As the author puts it, the stakeholders of the public, political, and scholarly communities became interested in the issue of the digital divide towards the end of the 1990s. About ICT, there has been an on-going debate on the inequality in terms 'knowledge gap, computer literacy, and participation in the information society' (*ibid*, p. 1). Scholars and policy makers, depending on the nature of their work and interest, use these terms to describe the level and patterns of inequality of access to ICT (and consequently, to information) in different parts of the world and in different sections of the society.'

3.1 What is digital divide?

What we mean by 'the digital divide' has changed since the mid-1990s when this concept first grabbed the attention of policy makers, educators, and information professionals. In the early days, the digital divide was simply defined as 'the gap between those who do and do not have access to computers and the Internet' (van Dijk, 2005, p. 1). Access then meant physical access, that is, 'having a personal computer and Internet connection' (*ibid*, p. 1). This is an important statement because just having physical access to hardware like computers and mobile phones cannot alone really close the digital divide, although having those devices is an important condition. More recently Van Dijk (2020, p. 1) added that "The term 'access' was emphasised in the first years of discourse, though later the 'use' was highlighted." We will return to this emphasis on the use later in this section.

The early focus on access was because in the 1980s only few people in the world had access to personal computers. With the invention of the World Wide Web in 1993 and the availability of personal computers to the masses, access to ICT was possible for more people. Therefore, the issue of some sections of the population not having access to ICT was beginning to be highlighted.

The website by Our World in Data (https://ourworldindata.org/) is a useful tool to explore the access to and the growth of internet in different parts of the world.

3.2 Defining digital divide

The Organisation for Economic Cooperation and Development (OECD) (2015, p. 123) considers digital divide as "Disparities in access to and proficiency in information and communication technology (ICT), particularly between socio-economically advantaged and disadvantaged children, and between rural and urban residents." OECD (*ibid*) emphasises that the 'opportunities' to be able to access ICT is critical for "civic participation, networking or improving one's productivity at work" and that "the unequal distribution of material, cultural and cognitive resources to tap into these opportunities may perpetuate and even exacerbate existing status differences".

Van Dijk (2020, p. 2) developed a helpful set of categories to understand digital divide from multiple perspectives. These are based on Van Dijk's own as well as Hilbert's (2011) definitions of digital divide.

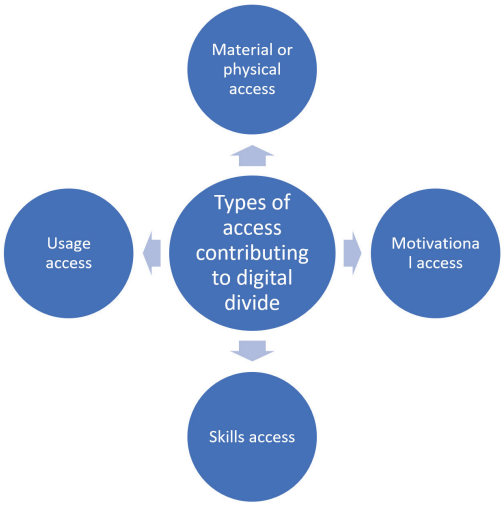

Figure 7. A process-based definition of digital divide (Source: Van Dijk, 2005; 2020).

First, **a general definition** of digital divide could be proposed based on simply meaning 'a division between people who have access to and use of digital media and those who do not' (Van Dijk, 2020, p. 2).

A process-based definition considers four phases in the access to and use of digital media: motivational access, physical access, digital skills and usage (Van Dijk, 2020). This particular way of looking at digital divide is offers a very useful 'conceptual division' of the term 'access'. It provides an insight into what 'access' really means (Figure 7) in different scenarios.

3.3 Closing digital divide: a trickle-down effect?

You might ask whether we should worry about the digital divide. If you were able to look at the infographics in Our World in Data website (mentioned earlier), or if you have had a look at the statistics on access to the internet and to different kinds of technologies (such as laptops, mobile phones) you might conclude that we don't really have much to worry about: the digital divide will be closed, given time. People, no matter where they are, will gain access to the Internet someday. After all, we are in the third decade of 21st century, we all have access to smart-phones, laptops, tablet computers and many other digital devices. We

needed these devices to keep us safe from the Covid-19 virus. We can pay for our access to the internet. Access to internet is free in most places we inhabit indeed. Or is it? Authors like Buckingham have been commenting on access issues for many years.

Buckingham's (2006) early definitions of the digital divide draw our attention to the fact that a digital divide can exist both within as well as between societies. He argues that the digital divide is 'the gap between the technology rich and the technology poor, both within and between societies' (ibid, p. 10). To put this into context, digital divides can occur even within an industrialised country, like the UK, between its different communities. A recent report by The Office of Communications (The Ofcom, 2021), the communications regulator in the UK, revealed that as of March 2021, about 1.5 million UK homes did not have access to the internet which is about 6% of households in the UK. One of the key summary points of the report is that "the pandemic has created a bigger digital divide" (*ibid,* p. 4). (The full report can be downloaded from the Ofcom website at https://www.ofcom.org.uk/). We have read about and heard heated debates on 'digital poverty' in the UK during the height of the Covid-19 pandemic.

A really interesting infographic showing statistics on the digital divide in the UK can be found in "AMAculturehive", a free online resource library website at https://www.culturehive.co.uk/resources/fixing-the-digital-divide-facts-and-stats/

The belief that closing the digital divide is only a matter of time was dominant in the early 2000. Then, there were many predictions about the future of technology and huge enthusiasm about the growth of the Internet and ownership of personal computers. As van Dijk (2005, p. 2) illustrates: 'In the developed countries, computer and Internet diffusion rapidly reached the majority. These media were getting cheaper and simpler by the day.' This increased expansion prompted the many stakeholders to believe that 'the diffusion of the new media was another instance of the so-called trickle-down principle.' According to this principle, 'some parts of the population always get access to new media first, buying the new technology when it is expensive and forcing the prices to drop. These segments of the population thus pay for the access of others who only get the new media a little later'.

van Dijk suggests that the enthusiastic politicians, policy makers and other stakeholders expected that the digital divide would be closed, based on their belief in the 'trickle down principle'. However, van Dijk (2005, p. 2) disagrees: "… the digital divide is far from closed. In most

parts of the world, it is still widening." A recent UN report (2020) too, shone a light on the level of digital divide in resource poor countries and how this has impacted on access to learning at all educational levels during the Covid-19 pandemic. Digital divide is far from closed. It is hidden from us.

3.4 The digital divide during Covid-19 pandemic

If the digital divide continues to exist, that is somewhat worrying given the importance of the Internet and digital technologies for education. It is widely recognised that the Internet is an essential part of infrastructure that can contribute to the development of the society. And those who do not have access to it, including learners, are clearly at a disadvantage.

You might be working in an economically more developed country where the published figures show that the access to the Internet is very high. But what was the experience of your students' access to learning resources and online classrooms for their learning and homework during the Covid-19 pandemic? Did all of them have access to the Internet in their homes? Were you aware of the access issues faced by some of your learners?

A key question for us as educators is what are the disadvantages of being on the 'have not' side of the digital divide? What are the consequences of the digital divide for learners, for teachers, for schools, and for education as a whole? What can we do, if anything at all, to address the inequalities of educational opportunities for our learners? Our experience as teachers and leaders in educational institutions (schools, colleges and universities) have given us some experience of digital divide during the unusual time of Covid-19 pandemic. The shift to online and remote learning during the pandemic has uncovered hidden digital divides in many parts of the world, and economically more developed countries like the UK was no exception to this phenomenon.

The purpose of this section is to highlight the existence of digital divides that we don't often see even in economically more affluent countries, like the UK. As we have discussed early in this section, one of the assumptions running through in discussions on access to technologies is that when a society becomes more affluent, there is going to be a trickle-down effect, meaning more people are going to have access to the internet and digital technologies. However, the recent experience

during the Covid-19 pandemic showed contradictory evidence as we shall see in this chapter.

How might COVID-19 linked to digital divide and students learning? As we have seen during the lockdowns, "stay home" was one of the key messages from various governments. Staying at home means loss of income for some families. And for children what it also means was that moving teaching and learning to online, with consequences for their learning. This is because moving teaching and learning from school to home is not a simple transfer of the location of learning. The ability for a child to learn from home can vary depending on the number of children in the household (Does each child have access to a digital device?), and the family educational background (Do the parent(s) have knowledge to support home learning?), access to the Internet, and many more factors. All of these are probably dependent on family income to some extent. So there are many factors that can contribute adversely to increasing the digital divide.

The quote below from a senior leader of Barnardo's (a British charity founded in 1866, caring for vulnerable children) summarises the points above. Michele Janes highlights that having access to devices and the ability to spend money on extra data and the electricity bills were key challenges for many families during the pandemic.

> A lot of our families either don't have access to the devices or they don't have access to the money for the extra data because the electricity bill has gone up now because we're charging and watching so many things at the minute. (Head of Barnardo Northern Ireland, Michele Janes. Barnardo's, quoted in BBC New Website, https://www.bbc.co.uk/news/av/uk-northern-ireland-52582610).

At the time of writing this chapter (Autumn of 2022), the price of electricity went up multi-fold in the UK (an in other countries as well) so it would be interesting to watch how these costs might play a part in limiting access to digital resources for learning.

The next quote is from a mother of two children who was having to juggle between working from home and helping her children's home learning during the pandemic. We can imagine the scenario where the mother and her children having to compete for the only computer at home. Living in a small house or a flat means the space can be a problem as well. Here she mentioned getting very stressed.

> We have four in our house, two kids, my husband and myself … I needed the computer because I was working from home and the two kids needed

> the computer for online learning. … . So it was very frustrating the three of us trying to use it at the same time and I was getting very stressed, because I needed to get work done and they needed it for online learning (a working mother of two children, cited in BBC New Website, https://www.bbc.co.uk/news/av/uk-northern-ireland-52582610).

The following points are also from BBC News website that summarises comments from school leaders during the after the first Covid-19 lockdown. These highlight the picture in which many children did not have access to digital devices and internet to work from home. And if there are more than many children in the family then it is difficult for them to share one device as well. The last quote is about six children sharing one mobile phone for homework.

> In our schools, 60% to 70% of children wouldn't have laptops
>
> 24% of pupils are off-line
>
> When families are struggling, the priority of food, not internet
>
> Many families rely on a single mobile phone for an internet connection
>
> A family who has one mobile phone shared between parents and three children
>
> Six children shared one phone for homework. A mother having to allocated them each one-hour sessions with the phone.
> (Sources: https://www.bbc.co.uk/news/education-52399589 [Digital poverty' in schools where few have laptops, By Sean Coughlan, 24 April 2020]; https://www.bbc.co.uk/news/uk-england-53323405, Digital divide: Six children sharing one phone for homework, 8 July 2020])

Cullinane and Montacute (2020, p. 1) report paints a vivid picture of the experience of parents, teachers and children during the early stages of the pandemic. They identified that the family environment and social class played a key background factor that determined the quality of home learning environment for children's learning. Parents with post-graduate degree were more likely to be able to provide help with children's homework. Middle class income families even if they didn't have such educational qualifications were able to support their children with privately funded education. So these quotes show that how the family environment and the social class can have an impact on parents being able to help children in their education.

> More than three quarters of parents with a postgraduate degree, and just over 60% of those with an undergraduate degree felt confident directing their child's learning, compared to less than half of parents with A level or GCSE level qualifications.
>
> Pupils from middle class homes are much more likely to access online learning from home (30%), compared to working class pupils (16%).
>
> At private schools, 51% of primary and 57% of secondary students have accessed online lessons every day, more than twice as likely as their counterparts in state schools.
>
> In the most deprived schools, 15% of teachers report that more than a third of their students would not have adequate access to an electronic device for learning from home, compared to only 2% in the most affluent state schools.
>
> 12% of those in the most deprived schools also felt that more than a third of their students would not have adequate internet access. (Cullinane and Montacute, 2020, pp. 2-3).

Cullinane and Montacute's (2020) survey of teachers' experience of remote teaching during the first few months of lockdown in the UK reveal a startling image of children's access to digital devices for their home learning (Figure 8).

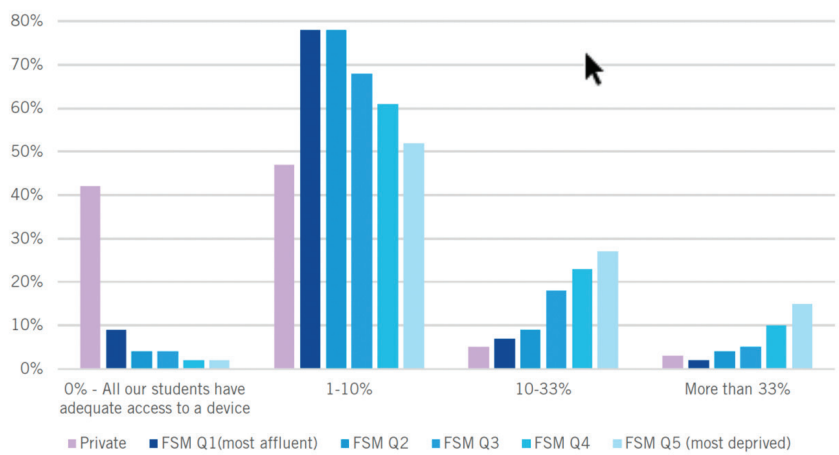

Figure 8. Proportion of children in a teacher's class working from home without adequate access to an electronic device for learning (eg. laptop/tablet), by level of deprivation in school. Source: Teacher Tapp survey of teachers in England, March 25th 2020.

In the most deprived schools (FSM Q5 meaning most deprived), 15% of teachers thought more than a third of their students would not have adequate access to a device, compared to only 2% in the most affluent state schools (FSM Q1 meaning most affluent). Notably, a large proportion of teachers in private schools (42%) thought all their students would have adequate access, compared to a much lower figure (just 9%) in the most well-off state schools, and only 2% in the poorest state schools. Most teachers put the figure between 1-10% of their class, with the median likely close to 5%, a substantial number of pupils over the whole country.

What we can concluded from the above data is that trickle down principle is not working for some sections of our society. Unequal access to digital technologies and resources is prevalent in high income countries, too. Poverty in economic terms can lead to digital poverty.

4. Open Educational Resources

In addition to the digital divide, the limitations of access to useful learning resources was another issue that educators and parents have experienced during the Pandemic. What if teachers, who are working in challenging economic circumstances and resource constraints are given access to learning resources without having to pay to use of those? This is where Open Educational Resources (OERs) would be useful, which is the focus of this section of the chapter.

There has been a growing interest in recent years in making educational content freely available. OERs have been making inroads into different sectors of education since 1998 when David Wiley, a USA-based educator, coined the term 'open content'. Terms such as 'open content' and 'Open Educational Resources' (OER) have gained currency and there is now a well-established international community of those interested in producing, using and researching OER. More recently, as the Educause Horizon Report (2020: 5) highlights, "at the October 2019 UNESCO General Conference meeting held in Paris, multiple governments unanimously agreed to the adoption of a set of standards regarding both legal and technical specifications, thereby clearing a path forward so that open materials can be shared across international boundaries."

The objective of this section of the chapter to summarise some of key issues on OERs. We start with a definition of OERS.

Butcher (2011) considers OERs as:

> ... any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without accompanying need to pay royalties and license fees. (Butcher, 2011, p.5).

Similarly, OECD define OERs as "Digitised materials offered freely and openly for educators, students and self – learners to use and reuse for teaching, learning and research (OECD, 2007, p. 133)."

The Hewlett foundation defines OER as "Teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others."

Note the key ideas from the above definitions of OERs from the perspective of teachers is the availability of recourses for teaching without having to pay royalties and licence fees. The two videos that can be accessed from the following links provide helpful explanations of the concept of OERs.

- https://www.youtube.com/watch?v=-xGRztrWv-k
- https://www.youtube.com/watch?v=ZFeyCc6we-s

The availability of free access to teaching and learning resources is relevant to the United Nations Sustainable Development Goals (SDGs), especially the goal number 4 on education. As the UN reports in 2020 highlighted the Covid-19 pandemic has worsened the prevailing educational inequalities in all levels of education in many countries including those in the Global South. Therefore, availability of OERs can help improve the educational outcomes for learners especially in the Global South. OERs have the potential to address inclusivity in education from a global perspective addressing the needs of education in resource-poor contexts.

The Educause Horizon Report (2020: 5) has identified OERs as one of five technologies and practices that 'will have a significant impact on the future of postsecondary teaching and learning' with 'considerable potential for ... positively impact[ing] on ... equity and inclusion'. Since the MIT's Open CourseWare Initiative in 2001 (Weller, 2020) a large body of literature has emerged documenting evidence of the potential of

OERs to increase access to, and improve the quality of education (eg., Ossiannilsson et al., 2020; UN, 2020; Hodgkinson-Williams and Arinto, 2017). Evidence is also available from resource constrained settings, eg., in Cameroon (Nkuyubwatsi, 2016), in India (Pande, 2018), in Ocenia, Koroivulaono (2014), and in Nigeria (Ofoegbu et al, 2021). More recently the relevance of OERs for education at all levels has been highlighted during remote teaching amidst Covid-19 pandemic (eg., Bordoli, 2021; UN, 2020; William and Werth, 2021).

As we already know, OERs are not new to education. Therefore, it can be argued that the inclusion of OERs in the Horizon 2020 report signals that "the substantial new developments" in OERs (ibid: 5). The term Open Educational Resources (OER) was first used by UNESCO at its 'Forum on the Impact of Open Courseware for Higher Education in Developing Countries' in 2002. However, it is worth noting that Massachusetts Institute of Technology (MIT) had already used this term in OpenCourseWare, initiated in 2001. As Educause (2020: 26) reports, the movement towards openness goes back to mid-1990s "thanks in large measure to an award from the NSF to Cal State University for the Multimedia Educational Resources for Learning and Online Teaching (MERLOT) repository."

Somewhat early years in the development of OERs, Iiyosh and Kumar (2008), through an edited collection, considered the wider notion of 'openness' and what it might mean in an educational context, in terms of open content, open technology and open knowledge. They argued that this is beginning to change the way educators use, share and improve educational resources and knowledge by making them freely available. They suggested that the central tenet of open education is that 'education can be improved by making educational assets visible and accessible and by harnessing the collective wisdom of a community of practice and reflection'. The early enthusiasm on OERs is captured inn Oblinger and Lombardi's (2008, p. 398) argument that "due to changes in technology, a participatory culture is emerging with a new openness to sharing, collaboration, and learning by doing."

The OER movement has been successful in promoting the idea that knowledge is a public good, expanding the aspirations of organisations and individuals to publish OER. However as yet the potential of OER to transform practice has not been realised; there is a need for both innovative forms of support on the creation and evaluation of OER, and an evolving empirical evidence-base about the effectiveness of OER. However, recognition of the importance of investment and effort

into promotion of the use and uptake of OER is evident in the prominence given to OER developments in a major report on cyberlearning, commissioned by the National Science Foundation (Borgeman, et al., 2008). Interestingly, "adopt programs and policies to promote Open Educational Resources" is one of the five higher-level recommendations in the conclusion to the report.

Researching Open Educational Resources raises issues about how to address global connections, reuse, design and evaluation of worldwide efforts to work with learning resources that are available for free use and alteration. This statement is evident in the following quote on OER from OECD:

> OER is not only a fascinating technological development and potentially a major educational tool. It accelerates the blurring of formal and informal learning, and of educational and broader cultural activities. It raises basic philosophical issues to do with the nature of ownership, with the validation of knowledge and with concepts such as altruism and collective goods. It reaches into issues of property and its distribution across the globe. It offers the prospect of a radically new approach to the sharing of knowledge, at a time when effective use of knowledge is seen more and more as the key to economic success, for both individuals and nations. How paradoxical this may turn out to be, and the form it will eventually take are entirely unforeseeable. The report offers some preliminary handles for understanding the issues raised (OECD, 2007:9).

OER practices are concerned with opening educational practices. For example, by shifting from teacher-directed to learner-centredness, where learners can be more actively involved in the creation and use of resources for their learning. It is about teachers moving away from content-centred teaching to learner-centred facilitation and about learning processes being seen as productive processes. Finally, the importance of learning outcomes is recognised, and they are seen as artefacts which are worth sharing and debating, improving and reusing.

A key problem in the use of OERs in education in some parts of the world is the availability of culturally and pedagogically relevant such resources. Availability of OERs depend on willingness of teachers in schools and universities to create resources that can be ready for sharing with other and reluctance to share such resources. In university contexts, it is rare for institutions to allocate scare resources to create learning resources that can be potentially used by their competitors. Another issue is the wider cultural and pedagogical relevance of OERs created by institutions in the global north. Therefore, we need sustainable

approaches to creating and sharing OERs based on empirical studies involving HEIs in the global south.

5. Final remarks

The aim of this chapter was to consider a systematic approach to using learning technologies while reminding ourselves the critical issues of digital divide that might prevent our learners from having access to technology-based learning opportunities. We also briefly considered the relevance of Open Educational Resources (OERs) to improve access to learning resources for both teachers and learners. We discussed these issues reflecting on our recent experience of teaching and learning in lockdown conditions during the Covid-19 pandemic.

The starting point of this chapter was that we need to consider about how technologies can be used in pedagogically sound ways. In this regard, the approach proposed was to think of a harmonious relationship between learning theories, models of learning and technologies. The starting point for this discussion was to think about learning as occurring through a continuum of activities: acquisition, participation and contribution. The notion of 6 types of learning, based on The Conversational Framework developed by Laurillard offers a simple way of thinking about what the leaners need to do to learn an aspect of the world that they are trying to make sense of. This kind of systematic approach enables us to choose technologies that are fit for purpose (i.e., to achieve learning).

While learning technologies offer us promising opportunities to create active forms of learning opportunities, we need to aware that not all learners have equal access to technologies and learning resources. This disparity was unearthed during the recent remote teaching episodes that we all have experienced during Covid-19 lockdown times. The issues of digital divide bas been a focus of discussion among educators since early 1990s when computers were entering households and classrooms and later with the diffusion of access to the Internet. Digital divide can play out in different ways in our society which we have discussed in the chapter.

The OERs, since the coining of term 'Open Content' in 1998, has come a long way especially in post-secondary education sector. International organisations such as the United Nations and many higher education institutions have been making efforts to raise awareness of the potential of OERs to improve access to high quality learning material.

However, there is still a long way to go before most of the teachers can access and use OERs.

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3

Education in Higher Education in the Era of Performativity

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CHAPTER 3

Education in Higher Education in the Era of Performativity

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1. Introduction

The studies on higher education have been concentrating their attention mainly on the organizational transformations, on the governance and management of the systems and institutions and to a lesser extent, as Peters and Barnett (2018) emphasise, on the concept of higher education itself: "university systems have mushroomed and universities have been established and developed with very little in the way of a consciousness that there is a long-standing literature that might inform the debate. There is a blanckness towards that literature. The university qua institution takes little heed of the university qua idea" (Peters & Barnett, 2018, p. XIII-XIV). This deficit of research on the idea of the university extends to the scarcity of reflection on what are the specificities of education in higher education. Higher education institutions in general and universities in particular have focused their efforts on adapting and articulating their structures and processes to the fluidity of the changes in their organizational environment. Indeed, in the area of higher education studies, research has proliferated on its governance and management, on the assessment of its quality, on

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accountability instruments, on the performance metrics of academics, researchers and management support staff, on internationalization and on the employability of its graduates. The educational dimension, when it is central, is more often than not to identify the 'relevant' set of competences and skills that, as learning outcomes, make graduates employable.

One might understand that, for example, the Organization for Cooperation and Development (OECD), given its nature, emphasises that "One of the main objectives of higher education is to provide its graduates with the skills needed to succeed in the labour market." (OECD, 2017, p. 9). Or that the World Bank underlines that "there is increased demand among employers for skilled and professional workers increased importance in modern economies for research and development to increase competitiveness" (World Bank, 2017, p. ix). What is inconsistent is that researchers on (higher) education have been neglecting the conceptualisation of the specificity of the educational dimension of higher education and its institutions.

The purpose of this chapter is indeed to urge the debate on the educational specificity of higher education and of the institutions where it takes place. To this end it is key to revisit the Modern matrix of higher education we have inherited and that in these days is either reconfiguring or dismantling. One the one hand, the link between the university and Reason has weakened and other public narratives about its nature and purpose emerged, such as the entrepreneurial university and others founded on its economic and social utility. On the other hand, linked to the growing dominance of these narratives it is important to underline that the development of a European political common grammar enacted by the 2000 Lisbon Agenda has been reconfiguring the environment within which the transformations in the educational experiences of students and teachers are evolving. The chapter also addresses the transformations brought about by information and communication technologies and digitalization of education, its governance and management. In fact, the transformation of materials, methods, and techniques to support educational processes and structures in digital language, is considered by some as a turning point in the history of education (Machekhina, 2017).

In sum, this chapter aims to contribute to the discussion about the educational specificity of the university and higher education, focusing on the combined effects of the centrality attributed to higher education

for social regional and national economic development and the increasing technologization and digitalization of teaching and learning.

2. The erosion of the Modern matrix of higher education

According to Gellert (1993), in Europe the Modern matrix of higher education was developed on the basis of three models: the model of Knowledge, matching the Humboldtian idea of the university (the 'research model'), the Professional, associated to the French *Grandes Écoles* (the 'training model') focused, mainly, on the training of cadres for the state apparatus; and that of Personality, related to the Oxbridge tradition, based on the idea of forming individuals through a liberal education (the 'personality model') (Gellert, 1993). However, whether as scientific, professional, or cultural institutions, these three models were narratively grounded in the matrix of modernity, sharing the celebration of reason, knowledge and critique as the basis of the educational processes (Barnett, 1997). They also shared social elitism, which still makes its way into higher education systems and institutions. The modern matrix of higher education provided a broad basis of consensus that, today, is being fragmented in a process dominated by a discourse that, potentially, conveys new identity(ies) of higher education and its institutions. (Magalhães, 2004; 2006). This discourse has been gaining visibility in the entrepreneurial/business and market narratives in higher education which, by subsuming higher education under the principle of performativity and economic relevance, potentiate the dilution of the specificity of the organizations dedicated to it as autonomous institutions dedicated to teaching, research and service to society. The education of individuals, citizens, and professionals, especially those who supported the state apparatus, was closely linked to the modern idea of higher education. Teaching, learning, students, teachers, classes, campuses, etc. were united both by the narrative based on the emancipatory potential of modern knowledge, and by the project of consolidation of the nation-state, that is, knowledge should be sought without interference, as a condition for the affirmation of 'national' culture and science (Magalhães, 2004). Teachers and students met in amphitheatres and laboratories and lived on campuses within an educational relationship mediated by the 'illuminating' function of knowledge and its applications. It was on these assumptions that, in part, the myth of universities as 'ivory towers' was built, obfuscating, in the pass, the

intrinsic connection of these institutions to the sociological elitism that marked them and, in many ways, continues to mark.

The modern ideal of higher education presupposed that the exposure of students to knowledge potentiated emancipatory and transformative characteristics in individuals, simultaneously providing society with higher education for citizens and training of specialized workers. Currently, in Europe under the influence of the Bologna process initiated in 1999 and the 2000 Lisbon Agenda, the centrality given to the development of competences, defined as the ability to summon knowledge, experiences and attitudes to deal with specific social situations, with an emphasis on work contexts, has been reconfiguring education in higher education. Research, in turn, was removed from the "ivory tower" to the terrain of "social relevance", challenging the institutional role, functions and missions, especially of universities. The trend towards segmentation between teaching and research functions questions the modern idea of higher education, in which institutions should teach what they research. Indeed, the 'higher' of higher education relied precisely on the link between research and teaching.

Over the last three decades these transformations of higher education have been traced. In 1996, Cowen (1996), underlined the 'attenuation' of the university in terms of *space*, given its international dimension and its connection with the global economy; *financially*, given the growing clientelisation of students and their families; at the *pedagogical* level, by means of the massification of higher education and the transformation of teachers/academics into 'instructional designers'; and, in terms of *quality* assessment, by the tendency to replace academics by specialized staff in the formulation of value judgments about the activities carried out in higher education institutions. These transformations impinged on the university's specificity as an institution and reflected in what Sousa Santos (1994) called the university's triple crisis: crisis of legitimacy, i.e., the failure of the objectives collectively assumed regarding the university; institutional crisis, referred to the questioning of its organizational specificity; and crisis of hegemony, related to the loss of the exclusivity of the knowledge that the university produces and transmits. Even the external borders of institutions seem to blur as the functions of higher education institutions are increasingly simulated by other organisations, as is the case, for example, of the awarding of degrees, which can also be awarded by companies, or research that is carried out by non-university laboratories and institutes, as in the USA, Great Britain, and China.

The growing emphasis on the relationship between higher education and economic and social development, on the articulation between higher education and the needs of the ever-changing labour market, and reforms in the governance and management of institutions have been marking the development and configuration of higher education all over the world. Transnational institutions such as the World Bank, UNESCO, the OECD and the European Union, by means of soft law mechanisms, have, in fact, been inducing changes and transformations that are reconfiguring higher education (Magalhães & Veiga, 2013) and the relationship between massification and democratisation of higher education. In these developments, what emerges as an important focus of discussion is the education provided by higher education institutions as embodied in the educational experiences of their students.

Consider, for example, the content of the publication of an OECD working group on 'alternative credentials' (Kato, Galán-Muros & Weko, 2020). The document, after underlining the increase in the number of higher education graduates in OECD countries, adds that

> … in recent years, new ways of acquiring and signalling skills are emerging, and engaging millions of learners. So-called "alternative credentials" – such as microcredentials, digital badges and industry-recognised certificates – have been touted as a means by which to fill a gap between the programmes that higher education institutions (HEIs) provide and the skills that firms seek; as a way of increasing the efficiency of higher education systems by offering more highly targeted training than traditional degree programmes; and as a force of innovation, permitting entirely new kinds of organisations to enter the higher education marketplace, and to create new ways for traditional HEIs to reach new learners across the world (Kato, *et al*., 2020, p. 7).

The purpose of the document is to support policy makers across the OECD countries in defining terminologies, identifying the characteristics of these credentials, analysing the profile of those who award and of those who are awarded the credentials, and the way in which employers and governments perceive them.

More than knowing whether this supply of alternatives for the provision and recognition of credentials calls into question the monopoly of higher education institutions in the identification and recognition of these credentials, it seems important to signal the assumption that higher education institutions must reform the experiences educational opportunities they provide to students and open the way to "entirely new

kinds of organisations to enter the higher education marketplace" (Kato, *et al.*, 2020, p. 7), to the detriment of the specificity of these experiences.

The question of how higher education institutions can develop teaching and learning alternatives that are not reduced to their value for money, emerges as central.

3. European higher education governance

To focus on the education issues in the context of higher education in Europe it is of importance to look at the role of political processes evolving at the European level. Indeed, they are shaping discourses and practices and creating a common grammar for European higher education (Magalhães *et al.*, 2013) with an impact on education and educational experiences.

The main political purpose of the European Higher Education Area (EHEA), as expressed in the Bologna Declaration, is to promote compatibility and comparability between European higher education systems to achieve three overarching objectives: mobility, employability, and attractiveness of European higher education. Although the Bologna process was based on intergovernmental decisions, the enactment of reforms it promoted was coupled with EU initiatives (e.g., the European Research Area) aimed at enhancing European integration (Magalhães & Veiga, 2018).

At the roots of the Bologna process there is a major policy driver promoting the interaction between education and innovation, whose meanings have been discursively associated in the EU policy discourses to the ideograph of 'knowledge society'. In 1997, the notion of a Europe of Knowledge was introduced by the European Commission (EC) in putting forward the Agenda for 2000 "to make 'knowledge-based policies' (innovation, research, education and training), one of the four fundamental pillars of the EU's internal policies [and] to raise the level of knowledge and skills of all Europe's citizens in order to promote employment" (European Commission, 1997, p. 1). In 1999, the Bologna Declaration considered that the degree awarded after the first cycle should also be relevant to the European labour market as an appropriate level of qualification. The ideograph of 'knowledge society' prompted the need to meet labour market demands and called for the development of competences and skills that higher education training is expected to develop. In 2003, this concern was directed to the need to develop

effective and closer cooperation between universities and industry, gearing more effectively towards innovation, new business start-ups and, more generally, the transfer and dissemination of knowledge (European Commission, 2003). In 2005, the ministers underlined that "As higher education is situated at the crossroads of research, education and innovation, it is also the key to Europe's competitiveness" (Bergen Communiqué, 2005: 5). In line with the goals of the Lisbon Agenda, the EC assumed that 'Modernisation is needed in order to face the challenges of globalisation and to develop the skills and capacity of the European workforce to be innovative' (European Commission 2007: 1) while pointing out three areas of 'possible reform' in higher education: curricular, governance and funding. Curricular reform was expected to bring in more differentiation in programmes, admission criteria and teaching/learning processes to cope with the diversity of learners, to enhance mobility, recognition, employability. to encourage the emergence of excellence and raise Europe's attractiveness.

Drawing on Etzkowitz's (1993) Triple Helix of university-industry-government relationships, the metaphor of the knowledge triangle, from 1997 onwards, has been driving and bringing forward the relationships between education, research, and innovation, underlining the dominance of innovation in its articulation with the two other vertexes of the triangle (Magalhães & Veiga, 2018). While the Triple Helix allowed for understanding the reconfiguration of the universities' 'third mission', the knowledge triangle emphasises the role of innovation in configuring the relationship between the university 'first' and 'second' missions, i.e., education and research. Innovation refers to the focus on the impact of higher education systems on economic development, on the enhancement of competitive advantages of regional systems and on the generation of skills for that purpose. Knowledge for economic and social development, exchange of knowledge and strengthening its impact based on international cooperation are the elements of the idea of innovation.

The articulation between education, research and innovation is visible in the views of the Bologna ministerial meetings (Magalhães & Veiga, 2018). The analysis of this articulation underlines the fact that it is contingent on both the political coordination of the EHEA and on the enactment of education reforms by European institutions, national governments, and higher education institutions.

The role of knowledge is changing on the basis of that articulation. As argued, while in the Modern matrix the relationship between

research and education featured what is 'higher' in higher education, the emphasis on their articulation with innovation impinges on and reshapes both knowledge transfer and knowledge dissemination, shifting the focus of education to competences and skills oriented towards economic development. To this account, innovation involves the relationship with industry and the economic fabric, and the training of a qualified workforce.

From the follow-up of the Bologna declaration, what nourishes the knowledge triangle and the articulations between its vertices is the increasing centrality of innovation. Chiefly after the Bergen meeting (2005), innovation became tightly articulated with education and research. While in the Berlin Communiqué (2003) the aim of preserving Europe's cultural richness and linguistic diversity was related to fostering "its potential of innovation and social and economic development through enhanced co-operation among European Higher Education Institutions" (Berlin Communiqué 2003, p. 2), the Bergen Communiqué (2005) clearly articulated innovation and education by assuming that "time is needed to optimise the impact of structural change on curricula and thus to ensure the introduction of the innovative teaching and learning processes that Europe needs" (Bergen Communiqué, 2005, p. 1), bringing in the need to strengthen the link between research, innovation and education. This was reaffirmed in the 2020 Rome communiqué urging higher education institutions to pursue their efforts "to respond to growing needs for innovative and critical thinking, emotional intelligence, leadership, teamwork and problem-solving abilities, as well as enterprising attitudes" (Rome Communiqué, 2020, p. 6).

The emphasis on skills for innovation reflects a mandate addressed to education systems and institutions to develop the 'right mix of skills' (European Commission, 2010a). While the report by the Expert Group on New Skills for New Jobs (2010b), prepared for the EC, emphasised that education and training "must be underpinned by transversal competences, especially digital and entrepreneurial competences, in order to both encourage initiative rather than simple reproduction of received knowledge and to better adapt to learners and employers' needs" (European Commission, 2010b: 5), the Innovation Policy Platform (IPP), developed by the Organisation for Economic Co-operation and Development (OECD) and the World Bank, underlines the need "to rebalance the emphasis between content knowledge and other skills such as creativity, communication, teamwork (…)" (https://www. innovationpolicyplatform.org/content/skills-innovation). According to the

OECD and the World Bank, the acquisition of innovation skills is to be based on (i) disciplines that are expected to equip students with skills that matter for innovation: technical skills, skills in thinking and creativity, and behavioural and social skills; (ii) pedagogies that must be active based on problem-based learning, cooperative learning, metacognitive learning, sometimes enhanced by information and communication technology and on interdisciplinary approaches focusing on design thinking to foster skills for innovation; (iii) new assessment instruments focusing on competences, rather than on knowledge per se, and (iv) international mobility of students, faculty, programmes and institutions introduced as a mean to foster skills for innovation in the globalised economy.

Notwithstanding, the educational impact of these political drivers and the transformations they induce in the students' learning experiences, did not emerge as central in the research agendas on higher education. Indeed, in 2005 the EC foresaw that

> In a few years from now, students, institutions, parents and employers in the wider Europe will be talking in terms of learning outcomes – what a graduate can actually do, at the end of his or her degree – and competences. This will certainly facilitate mobility and recognition across a wide variety of learning systems, as well as make our degrees more comprehensible for employers. (European Commission, 2005, p. 4).

The reference to 'learning outcomes' and 'competences' as central concepts when setting out objectives for education in European higher education represents a shift in the configuration of the educational processes that has been changing the meaning of the Modern educational categories such as students, teachers, teaching, learning, etc. The emerging model was referred to as a new educational paradigm (CEDEFOP, 2009) whose consequences for the students' and teachers' teaching and learning experiences in higher education are far from being fully researched.

In higher education, learning outcomes emerged as key elements of the Bologna reforms. Moreover, learning outcomes are embedded in lifelong learning policies being, indeed, the process of knowledge acquisition potentially narrowed to its instrumentality.

Apparently, the competence-based and learner-centred model has the educational potential foreseen by many educationalists to deal with the needs of post-industrial societies and with new forms of citizenship. In the *Shift to Learning Outcomes* (CEDEFOP, 2009, p. 129) it is argued that

> What can be referred to as a traditional 19th century paradigm, developed to respond to the needs of industrial society (learning in one place, for given periods of time, the teacher in front of the class, etc.) is repeatedly called into question, especially given the increasing possibilities for individuals to learn when, where, how and what they wish. Learners increasingly make choices about different modes of delivery, not least through their own initiative in using e-learning facilities.

The alleged educational paradigm promised a lot: the empowerment of the student, the enhancement of his/her capacity and responsibility to express his/her difference, the enhancement of teamwork, mutual help, learning by doing, etc. The educational debates on the learning process, on the centrality of students in the learning process

> are not calling on entirely new concepts or ideas; however, technology, along with the associated changes in communication, acts as a catalyst, making change unavoidable and increasing the pace at which it takes place. Further, what we learn has certainly become more problematic in the late 20th and early 21st centuries as the increasing rate at which knowledge and information are expanding and the resultant escalating pace of curriculum change is forcing us to focus on what should be included and what should be dropped from any syllabi. (CEDEFOP, 2009, p. 130).

However, the risk, it can be argued, is that knowledge by evolving away from a central formative input to a series of competencies which constitute the content of learning outcomes, may pass – like money... (Bernstein, 1996) – through the individuals apparently without transforming them (Magalhães & Stoer, 2003). Moreover, it is debatable that in higher education qualifications can be described and assessed in terms of learning outcomes independently of the site, the forms of provision and the pedagogy and curriculum convened to their achievement.

The point is that the educational debate cannot be confined to the discourse and processes marked by the social and economic relevance of higher education within which it has been evolving. As underlined by Nybon, "European higher education systems have been going through a process of major historical disorientation, and this has been brought about by the confluence of several simultaneous cultural and intellectual, as well as economic and political forces" (Nybom, 2012, p. 179).

Gibbs, Jameson & Elwick (2019) identify in higher education policies and practices a drift from education as an end in itself to an imperative to provide the economy what it needs and claim the specificity of higher education and its values. The same authors underline that "we need to

reassert basic academic values and set them in a moral context of care of care and tolerance, pushing back hard at the pervading values of individualism, consumerism and self-interest" (Gibbs *et al*., 2019, p.5). Giroux (2014) also emphasises that the formation of critical citizens is crucial for democracy, and that the university must play a central role in the development of formative cultures to make possible the existence of these citizens.

4. The digitalization of teaching and learning and the governance of higher education

In this context of fragmentation of the Modern matrix of higher education and its increasing functionalisation to the field of economy the issues raised by the incorporation of ICT and the digitization of processes and structures of education, research and governance of institutions gain relevance. It is about discussing how these means and instruments are transforming educational experiences in higher education, how do they articulate the changes mentioned above and how they affect the processes of democratic expansion of this educational level.

The configuration of teaching and learning, its materials, its methods, and techniques in digital language impact on education, educational and pedagogic relations, and ultimately on its forms of governance. Its importance was already visible in the priorities assumed in the European – and beyond Europe… – educational policy agendas but it was enhanced and strengthened by the crisis caused by the COVID-19 pandemic.

In 2017, the EC, in its vision for the development of a European Education Area (European Commission, 2017) highlighted the need to improve the quality and inclusion of education and emphasised the imperative of the development of digital competences and skills. In January 2018, the Commission adopted the first Digital Education Action Plan (2021-2027) and defined actions with the aim of supporting member states in addressing the challenges and opportunities arising from the use of digital technologies in education and training (European Commission, 2018). This plan focused on formal education (primary and secondary schools, vocational education and training, and higher education) and set out three priorities: making better use of digital technology for teaching and learning, developing relevant digital compe-

tences, and improving education through better data analysis and foresight.

The crisis triggered by the COVID-19 pandemic has given impetus and urgency to the issues of digitization and digital skills. Summoning the results of a public consultation carried out between February and September 2020, the EC has assumed the need to define practical guidelines at the European level, for ministries and education and training institutions, on ways to implement the distance, online and blended learning (European Commission, 2020a). Regarding higher education and the priority of developing digital competences with the aim of creating a European platform for higher education, the OpenU (*Online Pedagogical resources for European Universities*) project, funded through Erasmus+, started in April 2019 and was implemented by a consortium of 20 partners from 11 countries. The next step being the creation of a European hub for online and blended learning, virtual mobility, and exchange of good practices (European Commission, 2020b), In 2020, while recognizing that the priorities of the 2018 Action Plan remained relevant, the Commission underlined the need to update them in view of their long-term effects, due in part to the challenges posed by the pandemic. The Action Plan was revised, and two priorities were highlighted: promoting the development of an efficient digital education ecosystem and promoting skills and competences for digital transformation (European Commission, 2020b).

Thus, the digitization of education and the development of digital competences and skills have become a key political issue on the EU education policy agenda. However, the digitalization of education, in general, and of higher education, in particular, in addition to its impacts on teaching and learning, on the management of space and time of teachers, students and students, and on the institutions' support professionals, introduces transformations in the very conception of higher education. The use of digital technology must be seen in terms of the purpose of higher education, looking critically at the perspectives of the various stakeholders in this process. The study of these transformations constitutes a multidimensional research project, since it is knowledge, its nature, form of production, distribution and consumption, its social and educational value, that are at stake.

Lyotard, in 1979, in *The Postmodern Condition*, identified two forms of knowledge, the narrative and the scientific, and pointed out that in computerized information societies the latter would be the prevailing one. In his work on the status of knowledge in post-industrial societies

it was emphasized that, in this context, knowledge becomes an 'informational commodity' and the main force of production (Lyotard, 1984). From Lyotard's perspective, knowledge is a commodity circulating in a competitive market environment. The centrality and dominance assumed by knowledge susceptible of being translated and expressed in machine language, on the one hand, and its commodification, on the other hand, subsumes knowledge under the principle of performativity, that is, the maximization of results in relation to inputs. This means that knowledge is sought not so much for its value in itself, but for its exchange value.

Since its publication, Lyotard's work has been discussed by researchers on education. Roberts (2019), for instance, answered the question of whether Lyotard's announcement of the 'death of the professor' would have been fulfilled, by saying 'no' and 'yes', because, on the one hand,

> We continue to have universities, as physical spaces with campus grounds and buildings. On those campuses there are academic staff (faculty), who teach students on a face-to-face basis in classrooms, laboratories and lecture theatres. Professors are very much alive and well, with a presence not only in students' lives but in the wider world, with their expertise still in demand, in some fields at least, in the media, by governments, and in the corporate world. Professors and other faculty members are more active than ever in research, prompted in part by some of the trends foreshadowed by Lyotard's analysis – in particular, the emergence of new performance-based research funding regimes. (Roberts, 2019, p. 78).

On the other hand, he clarifies that:

> (…) death and dying, in a symbolic sense, are everywhere in the contemporary university. These changes are, in part, a reflection of developments in online education, yet they also signal deeper shifts in the way power is exercised across the globe. (Roberts, 2019, p. 78).

He concludes, then, that "process of commodifying knowledge, and of reconfiguring higher education in accordance with the performativity principle, is an incomplete project (…)" (Roberts, 2019, p. 78). It is precisely in this incompleteness that it is necessary to install the debate.

Since the end of the 2000s, the Massive Open Online Courses (mooc), have gained visibility in higher education and are being pointed out as "a new trend of learning for digital learners" (Suresh & Srinivasan, 2020, p. 96). Their teaching and learning models can be seen as an example of the mark of, at least at the institutional level, performa-

tivity in the current educational contexts of higher education. In 2017, hundreds of institutions, in partnership with Coursera, edX and Udacity, were already offering moocs to more than 10 million participants from all over the world (Longstaff, 2017). Based on the wide availability of online resources and by means of a modular, online, video-based format, the mooc are a way at the universities disposal to sell their 'products' to a global audience at no or very little cost to participants (Longstaff, 2017). However, the mooc have been questioned not only because the success rates of their participants are around 13% (Howarth, *et al*., 2016), but also, differently from what would be expected, the individuals with more comfortable economic situations and with higher levels of education are those who tend to seek and take these courses (Evans & Mcintrye, 2016). Furthermore, the contours of its conception of educational processes, its instruments, and pedagogical relationships, are a sign and an analyser of the transformations that higher education is experiencing. Furthermore, in this context, the visibility and key-role of actors such as professionals who translate classes recorded in mooc, specialists in online and distance education, not to mention companies and institutions that make the digitalization of education the core of their activity.

Education and training have been incorporating the digitization of teaching and learning processes and reconfiguring the educational experiences provided to students in higher education institutions (Fevolden, & Tømte, 2015). ICT influences all dimensions of education and teachers, students, teaching and learning space and time, and the methodologies and techniques of teaching and learning are being transformed by the combined effect of digitization and the pressure of performativity, as well as by the interests of the different actors involved in them.

The political grammar of the governance and management of the system and of higher education institutions is potentially reinforced by the adoption of digital instruments and rationales, with digital governance being a powerful means at its service. Digital governance instruments are visible in the expansion of highly complex technical infrastructures for collecting, storing, analysing and disseminating data at national and international levels. Education-related data are a product that results from the confluence of networks, technology and policies that develop beyond formal education systems (Williamson, 2020). Higher education institutions and their stakeholders generate data and network activities that can be used to analyse how students learn to enhance their

results. Adaptive learning systems, learning analytics and 'big data' gain a central role in the governance of higher education at the level of systems, institutions, and of pedagogical relationships.

Williamson (2020) draws attention to the fact that "While digital governance conceptualizes the changing practices of the state – and the technical institutions that increasingly co-constitute state power – as the digital data become available to conduct a constant audit of the population [...] algorithmic governmentality registers, in a more Foucauldian sense how the algorithms that process digital data may be used to intervene in and govern people's lives" (Williamson, 2020: 25-26).

This researcher presents, as an example, the Pearson's project and action as an exemplary case of the digital governance of education, which cannot be isolated from the expansion of the global digital economy. The company is pointed out as being among the most successful in the education market and an important influencer of educational policies. In 2016, Pearson has reinforced the priority of being the first company of the digital education by the creation of a digital learning platform, combining, in one architecture, cloud-based services with systematic computational analysis of data or statistics, and the possibilities of the learning machine (Williamson, 2020). One of the targeted goals, especially via the development of artificial intelligence, is the direct and individualized interaction with students "and so shape their cognitive capacity towards particular instrumental ends" (Williamson, 2020: 38), personalizing learning processes. Michel Foucault's approach to techniques of governmentality comes to mind. "Governmentality," or the "conduct of conduct" (Foucault, 1991), relies on knowledge construed by political powers through the collection and analysis of data to intervene in the lives of individuals and manage populations.

Therefore, the agenda for the study of higher education governance requires, on the one hand, the identification of political networks of actors and experts, and, on the other hand, the analysis of specific ideas and techniques for achieving the goals set. How educational policies are generated, under what influences, and how do the state, the private sector, experts, and civil society relate to each other brings to the fore the techniques that aim to establish discourses, new routines, and practices in higher education institutions and their contexts. Lascoumes and Galès (2007) emphasize, precisely, that policy instruments are a condensed form of knowledge about social control and, because they

are not neutral, they produce specific effects, which shape public policy under their own logic (Lascoumes & Galès, 2007: 3).

In his announcement of a new condition of knowledge, Lyotard predicted that "The old principle that the acquisition of knowledge is indissociable from the training (*Bildung*) of minds, or even of individuals, is becoming obsolete and will become ever more so." (Lyotard, 1984, p. 4).

The migration of the educational experiences of students and teachers to the ether of the www, the reconfiguration of educational spaces and time, the growing transformation of competences and qualifications acquired in higher education into merchandise, in a context in which the governance of higher education systems and institutions increasingly assume performativity as a criterion of value, are at the core of the urgent debate on what higher education is, as well as its social value. Ultimately, with the announced end of the grand narrative of Modernity and the centrality of the production and acquisition of knowledge as a process of educating individuals and citizens, it is not only the founding narratives of higher education that are at stake, but the very conception of higher education.

Michael Peters and Fazal Rizvi, in the introduction of a collective work on the new pedagogical possibilities for universities, in the post-COVID-19 context, emphasized that "Digital pedagogies are of course not neutral with respect to the type of sociability they encourage" (Peters *et al*., 2020, p. 2), also calling for a rethink not only of the possibilities provided by digital technologies and online activities, but also of the basic purposes of education and their contribution to the development of more sustainable, democratic and just societies.

Dirk Van Damme (Van Damme, 2020), in a publication by the Academic Cooperation Association (ACA) gathering a set of reflections from various academics and institutional leaders on 'The world after COVID-19' (ACA, 2020), concludes that the

> really important question then is what intrinsically defines the university experience which makes it so worthwhile. Even if massification has fundamentally modified the dream of the medieval encounter between the master and the pupil or the Humboldtian ideal of research-based *Bildung*, many students and graduates would still see the personal exchange with researchers and professors and the small-group collaboration with students in laboratories and seminars as the most valuable learning experiences. (Van Damme, 2020, p. 29).

The question is, therefore, to know what role the centrality of ICT and the increasing digitalization of educational processes and materials play in the dilution of the university inherited from Modernity and the reconfiguration of the educational experiences linked to it, as well as how it affects the processes of democratic expansion of higher education.

Thus, it is not a question of denying the potential advantages of migrating important parts of teaching and learning to the virtual and online world, but rather debating how curricula can integrate an inclusive, ecological approach to the educational experiences of students in the context of interactions in national and international academic networks and virtual platforms. The reformulation of agendas and the definition of priorities by higher education systems and institutions will certainly integrate virtual and online education and training, but it is important that the face-to-face and small-group collaboration pedagogical relationship are not underestimated as an accessory in the educational process, and that the issue of inequalities in access and success in higher education not be secondary. In fact, we have learned from the pandemic period that higher education students from economically weaker social groups are the ones who have suffered the most from it. In the same way, it also important to question the prioritisation and curricular isolation of training in the disciplinary areas of Science, Technology, Engineering and Mathematics (STEM), placing in the background the relevance of the social and human sciences, the humanities, and the arts in higher education.

Regarding the governance and management of institutions, it is important that, due to the growing centrality of computer instruments for monitoring the performance of institutions, academics, students and technical support staff, the weakening of the values of freedom of teaching and learning and academic autonomy is not reinforced. In recent decades, in Europe, with nuances and differences in the pace of implementation, reforms in the governance and management of higher education systems and institutions have been inducing managerial rationales that have promoted the weakening of academic self-governance, that is, the decline in their influence on institutional decision-making processes and structures, the increase in the preponderance of managers and management logics in these processes and the increase in representation, and the role attributed to representatives of external interests in the governance of institutions (Magalhães &; Veiga, 2020; Veiga; Magalhães & Amaral, 2015). Thus, it is important to debate whether and how the digitization of higher education enhances

the transformations that have been underway for decades at the system and institutional levels (Neave, 2012) which, ultimately, can jeopardize basic values such as the freedom of academics, critical thinking, and the autonomy of higher education institutions itself.

Conclusion

What is at stake is the role of higher education institutions, in general, and particularly of the university in promoting learning environments that develop students' potential for critical engagement and active participation in the digital age. Between the discourse of technophobia and the uncritical celebration of digitalization with the migration to the www of educational experiences, and aware of the interests involved in this process and the purposes of the actors in it, the challenge is to reconceptualise the processes of education and governance institutions, with a view to their integrity and democracy.

Johnston, MacNeill and Smyth (2018) propose a critical distance in the face of the digitisation of education and its governance, underlining that, despite its growing presence, the concept of the digital university is diffuse and indeterminate. The authors point out how digital technologies and practices challenge us to rethink the positioning of higher education institutions and how they can enhance higher education as a public good. They bring to this debate the issue of the digitally distributed curriculum and the issues of open education and critical pedagogy as the basis of the learning experience of higher education students.

The debate on the concept of higher education in the digital age must assume a broader horizon than that of the urgency of responses to the digital economy and the demands of digital labour market. The key question is about bringing into the agenda of the field of education research and educational policies favouring the creation of learning environments in line with the specificities of higher education experiences, not restricting the debate to a technocentric perspective. It is about integrating practices based on digital technologies, moving social and educational processes to the centre of the planning of organizational changes and reinforcing the public nature of the participation of institutions and higher education in the context of the digital age. In other words, rather than merely focusing on the potentials of digital teaching and learning it is crucial that the discussion draws on the value and quality of education, and how teaching and learning can integrate

the digital technological structures and processes. Johnston, MacNeill and Smyth (2018) identified the trend towards the uncritical integration of digital in current structures and processes within the university, to the detriment of questioning how digitalization challenges the commitment to higher education and how it can be reconfigured and reimagined (Johnston, MacNeill & Smyth, 2018).

It is neither a matter of building a new founding and legitimising grand-narrative of higher education, nor of sinking in the grip of the economic relevance of education, disseminated and induced by the dominant political grammar. Otherwise, considering the discourses and political drivers that dominate the field of higher education, the idea is to propose that the political and educational debate focuses on the quality of education experiences provided to students in the context of higher education. This debate, therefore, calls for reflection on what higher education is. Barnett (2004), positioning himself in relation to the discourses that announce the dissolution of the university, suggests that

> What is emerging (...), perhaps, is a glimpse of an 'authentic university'. Authenticity becomes possible precisely where authenticity is threatened. (...) The gaining of the authenticity too (...) is a set of creative acts, in which new pedagogies, new academic practices and new research approaches are painstakingly and painfully developed. (Barnett, 2004, p. 206).

Actually, the dissolving of the university does not hinder the centrality of higher education, as "Higher education [...] has to be seen as central but in a new way. No longer a vehicle for the reproduction of knowledge elites or the production of labour market competences, higher education has the crucial task of supplying in large measure this reflexive capacity" (Barnett, 1997, p. 6). Thus, higher education is assumed as a social institution with the role of supporting and developing transformative action, and as an important reserve of critical, reflective and alternative thinking. Notwithstanding, it is important to add that professions of faith about the importance of higher education and its transformative role are not enough, and reflective action is also urgent.

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Part II

A Proposal for PBL Practice in Higher Education

4

Project-Based Learning Experiences Devised by Combining Backward Educational Design and Design Thinking

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CHAPTER 4

Project-Based Learning Experiences Devised by Combining Backward Educational Design and Design Thinking

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1. Introduction

Given the large diversity of teaching and learning methodologies in higher education, an issue facing many educators, is to choose and apply the most effective approaches. Recent research has shown that unlike traditional teacher-centered approaches, active learning methods, which foster experiential involvement of the students, are more effective than lecturing in enhancing student performance (Freeman et al. 2014, Baepler et al. 2014). In the case of large classes active methods imply teaching more by asking than by telling (Freeman et al. 2014). In this sense, the think-pair-share method (Prahl 2017) as well as the use of "clickers" (audience response systems), has been shown to improve the student learning experience and to support the learning process (Mayer et al., 2009; Blasco-Arcas et al., 2013). Modern information and communication technologies have led to the gradual replacement of clickers by online poll/quiz platforms, which allow students to answer questions and to see group responses in real time (Wang and Tahir, 2020; Mayhew 2019). For regular size classes tradi-

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tional lectures can be replaced or at least complemented by alternative methods, such as role playing (DeNeve and Heppner 1997), forum-theater (Hakkarainen and Vapalahti, 2011), debates (Osborne, 2010), particularly in the humanities and social sciences, but more recently also in the medical sciences (Estai and Bunt, 2016). In natural sciences and engineering some of the most commonly used active teaching methods (Prince, 2013; Prince and Felder, 2013) are inquiry-based learning (Minner et al., 2010), problem-based learning (Barrows, 1996), project-based learning (Blumenfeld et al. 1991), case-based teaching (Jonassen and Hernandez-Serrano, 2002), and just-in-time teaching (Kester et al., 2001). They are classroom-based pedagogies of engagement (Smith et al., 2005) which reflect the changing role of education in schools and universities (Griffin et al., 2012).

Gaining more and more recognition for its impact on student learning and achievement is the emotional dimension. Reviews published three decades ago discussed how emotions may affect learning (Bower, 1992; Pekrun, 1992), acknowledging that, with the exception of test anxiety, academic emotions had largely been neglected by educational psychology. Although anxiety had been reported most often, other emotions identified as experienced by students in academic environments were enjoyment, hope, pride, relief, anger, anxiety, shame, hopelessness, and boredom (Pekrun et al., 2002). To measure emotions in students' learning and performance a dedicated questionnaire was designed, constructed to assess various achievement emotions experienced by students in academic settings (Pekrun et al., 2011). A more recent study, reported results of applying a battery of 3 questionnaires on self-regulated learning, emotions, and motivation (Mega et al., 2014). It found that the emotions experienced by the students influence their self-regulated learning and their motivation, and these, in turn, affect academic achievement. Independently, other authors concluded that if educators fail to appreciate the importance of students' emotions, they fail to appreciate a critical force in students ' learning (Immordino-Yang and Damasio, 2007).

Assuming the goal to contribute to the improvement of the academic performance of the students of Ovidius University of Constanța, we were aware that the process of changing teaching methods is sometimes met with resistance by the academic staff (van Veen et al., 2005). The reform of the educational practices requires a clear understanding of the concerns of individual teachers, of the obstacles they face, and of the assistance they need. Recognizing that emotions such as anxiety, anger, guilt, and shame, are important and have an impact on teachers'

enthusiasm for reforms (van Veen et al., 2005), we tried to design a training course on project-based learning that meets the requirements of effective teaching. We wanted the course to be engaging and sympathetic with the socio-emotional needs of the trainees.

We sought to address the learning needs of our colleagues and assist them in finding answers to questions they face. Examples are: "Where do I start to design the course?", "How do I determine what skills should be developed by that discipline and how do I formulate learning outcomes?", "What assessment methods are appropriate for the subject and my students?", "How do I determine the most effective methods to involve students in the learning process?"

In designing the training course we started from the belief that education can benefit from the progress made in other fields of human endeavor, particularly the ideas about human-centered design developed in the context of innovation and entrepreneurship. Our background that mixes exact sciences and engineering with education allowed us to fuse together the Design Thinking approach, advanced by Stanford University's design school (Lewrick et al., 2018; Lewrick et al., 2020), with backward educational design (Wiggins and McTighe, 2005; Wiggins and McTighe, 2011). This approach was used to design and implement a training course on Project-Based Learning (PBL) under the Restart4Edu project.

2. Guiding Principles

This methodology is based on five guiding principles, inspired by the Backward Educational Design approach and the Design Thinking method.

The first principle, ***Focus on students!***, requires to center the whole approach on the learners, which implies an empathic effort to understand and satisfy the real needs of the students, from the perspective of both the topics and content and the socio-emotional component of learning. The second principle, ***Begin with the end in mind!***, recommends to start with clearly formulated learning outcomes, and not with the content to be covered. If the traditional approach leaves students without a clear answer to the question of what is the point of that educational endeavor, backwards educational design starts from the relevance and authenticity of the topic.

The active involvement of learners in the learning process is the subject of the third principle, ***Show don't tell!*** It invites teachers to balance the effort, shifting the focus from the educator, from teaching

and lecturing, to the student, to learning and discovery. The students are guided to experiment, discover, explain and generalize, in the process of acquiring and developing competences. The fourth principle, ***Foster radical collaboration!***, urges to promote collaboration among students, encouraging learning through collective effort, recognizing that real-world challenges require working in multidisciplinary teams.

Finally, the fifth principle, ***Walk the talk!***, advises teachers to be consistent and to inspire by personal example. If we are to implement the change, we need to practice what we preach, and show commitment, coherence and reliability.

3. Course Design and Implementation

As our approach in planning and implementing the training course on PBL blends two techniques: backward educational design and design thinking, we start with their brief description. *Backward Educational Design* (Wiggins and McTighe, 2005; Wiggins and McTighe, 2011) is an approach to creating new curriculum or revising an existing one, starting from the end goals, from the envisioned learning outcomes, as opposed to the more traditional method, which focuses on the topics to be covered or maybe even on the textbook to be used. The three stage process (Fig. 1) consists of i) identifying the desired results, ii) determining acceptable evidence of learning and iii) planning the learning experiences and instruction.

As backwards design is not an approach to teaching but rather a planning framework, it does not guarantee by itself that its outcome is a great learning experience. The backward design needs to be complemented by a method that centers everything on how the students learn, on how they think and how they feel. As empathy is essential to *Design Thinking* (Lewrick et al., 2018; Lewrick et al., 2020), this creative method can be used to plan an experience that allows students to achieve the learning outcomes in a way that is satisfying to them (Brown, 2009; Kelley and Kelley, 2013).

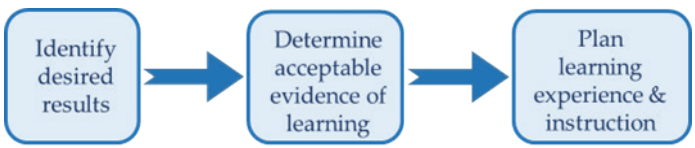

Figure 1. Stages in the backward design process. (Based on Wiggins and McTighe, 2005).

The key steps in the design thinking process (Lewrick et al., 2018) are shown in Fig. 2. The first step is to learn more about the potential users, their needs, and the tasks that they must complete. The second phase is to observe the potential users at the place where they are located. During the third stage the findings gathered are evaluated, interpreted, and summarized into a point of view. Here the problem space ends and the solution space begins. Ideation is a step toward finding solutions, usually through different forms of brainstorming. By building a prototype the solution can be tested and, if the feedback is

Figure 2. Stages in the Design thinking process. (Based on Lewrick et al., 2018).

negative the process can return to ideation. Reflection is a continuous practice during the design thinking process but, at the end, it serves an additional purpose, as it sets the ground for tackling another challenge.

As design thinking is based on a "show don't tell" philosophy (Doorley et al., 2018), to be consistent with the approach and to practice what is preached, in the following, the accent will be on clarity and simplicity, with examples and hands-on exercises. The use of backward design and design thinking, together, will be illustrated for the planning of a teaching course on PBL.

3.1 Identify desired results

The first stage in the backward design process consists of identifying the goals, the desired results after completion of the training course. We ask ourselves not only questions like "What should students know, understand and be able to do?" but also "Why and in what context is that knowledge necessary to the student?"

Any attempt to answer such questions ought to start from the fact that knowledge is only part of a holistic concept of competency, involving the mobilization of knowledge, skills, attitudes and values to meet complex demands, as emphasized by the OECD Learning Compass 2030 (OECD, 2018) (see Fig. 3). The OECD Future of Education and Skills 2030 project (OECD, 2019) underlines that students need to be able to use their knowledge, skills, attitudes and values to act in coherent and

Competencies	Knowledge	Disciplinary
		Interdisciplinary
		Epistemic
		Procedural
	Skills	Cognitive & metacognitive
		Social & emotional
		Physical & practical
	Attitudes and Values	Personal
		Social
		Societal
		Global

Figure 3. Classification of competencies. (Based on OECD, 2018).

responsible ways that change the future for the better.

OECD's reports on learning (OECD, 2016) present a vision on competencies shared by the European Union (European Commission, 2011), which goes further by encouraging the use of learning outcomes to describe the specific competency (knowledge, skills, values and attitudes) that the learner will get from a learning activity (Kennedy et al. 2009a, European Council, 2018; CEDEFOP, 2017). The learning outcomes are statements of measurable achievements that the learner will be able to demonstrate in terms of knowledge, skills and attitudes upon completion of a program (CEDEFOP, 2017). While competencies are broad statements that outline the knowledge, skills and attitudes of the graduate, learning outcomes bring the needed level of detail, creating the operational foundation for both learning and assessment (Kennedy et al., 2009b; Oliver et al., 2008).

In the case of a course on PBL, the teachers should master the fundamental pedagogical concepts related to educational design, to teaching and learning. In particular, the trainees are expected to deepen their understanding of all three types of competences and develop skills of writing appropriate learning outcomes. They should be able to choose suitable evaluation methods and write complex rubrics to assess student performance. Finally, the teachers should be able to select applicable active learning methods and to plan a learning unit exercising empathy und understanding for students' emotions. Additionally, the trainees are expected to acquire knowledge of backward design and design thinking approaches and apply those competencies to design a student-centered PBL unit. Moreover, they should work in transdisciplinary teams to solve complex pedagogical assignments, showing respect to their colleagues and peers, communicating effectively and upholding the code of academic conduct.

Writing effective learning outcomes requires not just exploring a diversity of types of competencies but also a variety of levels of achievement. Useful in that sense is Bloom's taxonomy, which proposed a hierarchy of learning for the cognitive (Bloom et al., 1956), affective (Bloom et al., 1964) and psychomotor (Dave et al., 1970) domains, respectively, making distinctions between basic and higher levels of mastering that knowledge and skills. Later on, the taxonomy was revised (Anderson et al., 2001), using verbs instead of nouns and changing the bottom and top levels of the cognitive hierarchy. Although Bloom's revised taxonomy is not without its critics, for practitioners (for whom theoretical subtleties are less important), the hierarchies are useful, particularly in countries where the reform of curricular design is still incipient. The rankings for all three

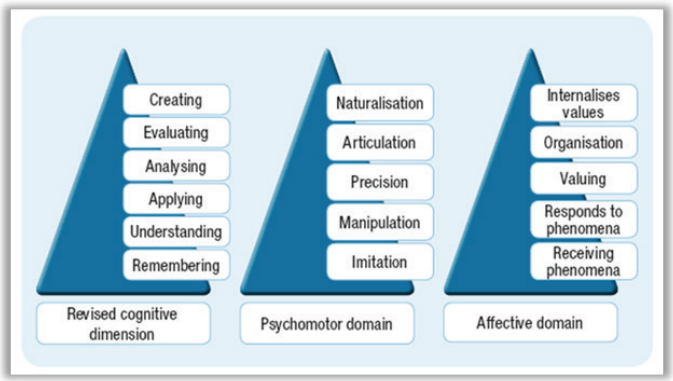

Figure 4. Bloom's taxonomy for cognitive, psychomotor and affective domains (from CEDEFOP, 2017).

domains are represented as pyramids in Fig. 4.

The writing of the learning outcomes is well presented in various handbooks (Kennedy, 2006; CEDEFOP, 2017). The typical structure of a learning outcome consists of a subject (the learner can be any type of person undergoing some kind of instruction), the action that the subject will be able to perform (expressed through a verb that signals the level of learning achieved), the object and scope (the depth, breadth etc., of learning accomplished) and the context in which that accomplishment is relevant (CEDEFOP, 2017). Useful lists of verbs widely used in stating learning outcomes, compiled from a combination of Bloom's original publication as well as the modern literature in the area, are available for each level in the hierarchy of learning (Kennedy, 2006).

Possible examples of learning outcomes for the training course

on PBL are displayed in Table 1. They address various types of competencies, differentiate between levels of achievement of that competency and include a context, to indicate its relevance. The first example refers to knowledge, at a lower level ("explain and interpret"), whereas the next three to applied knowledge (and skills) at a higher level, which requires some degree of creativity. The fifth example illustrates digital skills, whereas the sixth and seventh refer to social skills. Finally, the eight learning outcome addresses attitudes and values.

	Subject	Action	Object & goal	Context
1	The trainee	will be able to explain and interpret	fundamental pedagogical concepts related to educational design and PBL	to peers interested in improving teaching skills.
2	The trainee	will be able to formulate	appropriate and diverse learning outcomes	specific to the discipline and the students they teach.
3	The trainee	will be able to conceive	complex evaluation rubrics	which allow a quality assessment of student performance.
4	The trainee	will be able to plan	a PBL unit, using backward educational design	exercising empathy for students' emotions and social needs.
5	The trainee	will be able to use	digital tools and online platforms	which facilitate communication and access to resources.
6	The trainee	will be able to work in transdisciplinary teams	to plan, carry out, present, and evaluate an effort to solve	a complex assignment on educational design.
7	The trainee	will be able to practice adaptively and creatively	empathy towards peers as well as students	when working in teams and while planning learning experiences.
8	The trainee	will respect voluntarily	the ethical and deontological code of conduct	promoting academic values of honesty, trust, fairness, respect and responsibility.

Table 1. Examples of possible learning outcomes for a training course on PBL.

The last task in the first phase of backward design is to rank the learning outcomes by their importance. When prioritizing learning outcomes (Wiggins and McTighe, 2005), it may be useful to differentiate between essential knowledge, skills and attitudes (which must be deeply understood and practiced diligently), important (which must be known and applied), and secondary (with which students deserve to be familiar).

In order to determine which of the three types a particular competency would fall into, one can look for the answer to the question of how important it is for that knowledge, skill, or attitude to withstand the passage of time. Will these be useful in the long run, to insist on them? To what extent those competencies are indispensable for the subject or relevant and motivating for future students? (Wiggins and McTighe, 2011).

The importance of the learning outcome needs to be correlated with the level of achievement in Bloom's taxonomy. This correspondence is illustrated in Fig. 5, which indicates that lower levels of accomplishment are likely linked to knowledge that is secondary, whereas higher levels of expertise may be associated with essential knowledge. For instance, memorizing statistics and facts about the PBL educational approach is secondary, whereas applying the method is important and designing high quality learning experiences is essential.

3.2 Select appropriate assessment instruments

The second stage in the process of reverse design is to determine the criteria and methods of assessment based on which the achievement of learning outcomes is verified (Wiggins and McTighe, 2011). The collection of evidence demonstrating the acquisition of skills must be considered before the actual design of the learning units. It is preferable to choose a diverse set of assessment methods, broken down over the entire period of teaching activities, including questions and dialogues, observations, tests and questionnaires, topics and projects, etc. (see Fig. 5). It is desirable that the evaluation methods be diverse also in

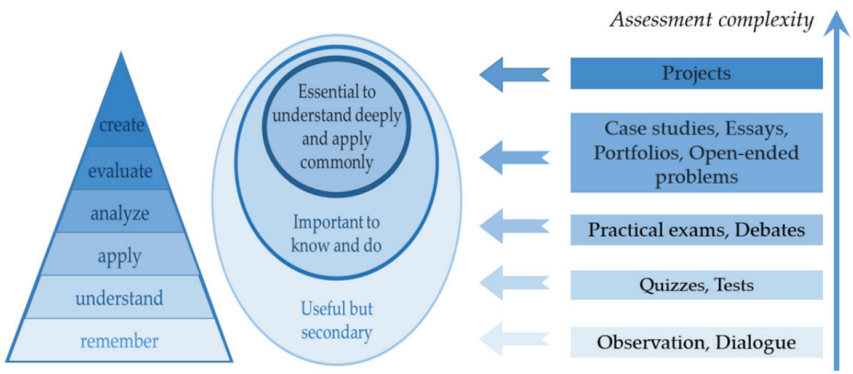

Figure 5. Correlation between the level of achievement in Bloom's taxonomy, the importance of learning outcomes and the types of assessment. (Inspired by Wiggins and McTighe, 2011).

terms of complexity, duration, context, structure, etc. The verification should not be a simple immortalization of existing knowledge at a given time; instead, it should capture the evolution in time of the students, in terms of knowledge, skills and attitudes.

The complexity of the evaluation should be correlated with the importance of the learning outcome and with the level of achievement in Bloom's taxonomy. For instance, Fig. 5 suggests that oral assessments are suitable achievement of secondary learning outcomes. By asking questions or designing plausible hypothetical situations we allow students to apply new knowledge or practice newly acquired skills, creating a context in which they gain a sense of confidence that mere memorization cannot generate. In order to assess the acquisition of important competencies, it would be preferable to employ more complex tests, with both predefined and open answers, homework assignments and problems, to verify the analysis, critical comparison skills etc. Finally, for the core competencies, it is recommended to evaluate through a project, which allows a more complex assessment, an evaluation of a broader set of competencies.

Returning to our example of the training course on PBL, one could imagine that questions and simple exercises allow a rapid and effective check of understanding and student progress, for instance by identifying, differentiating, and classifying various types of competencies, diverse levels of achievement for that competency, distinct instruments of assessment or methods of teaching and class interaction. Homework assignments may be used to check more important and complex skills, such as formulating relevant learning outcomes, devising suitable assessment rubrics, selecting appropriate driving questions, practicing empathy exercises etc. Assembling all work and completing the final project, to design a PBL unit, could develop enduring knowledge, that the trainees would use in their subsequent teaching activities.

Once the appropriate assessment methods are selected, suitable instruments need to be prepared. The use of rubrics has been studied (Reddy and Andrade, 2010), revealing that student perceptions are generally positive whereas those of instructors are mixed, some being hesitant if not resistant to using them. Students tend to appreciate rubrics as they clarify expectation, reduce uncertainty, and facilitate self-assessment (Andrade and Du, 2005). In contrast, instructors seem more inclined to focus on assigning grades more accurately than on guiding student progress (Reddy and Andrade, 2010).

A typical rubric has three essential components: evaluation criteria, quality definitions and a scoring strategy (Popham 1997). Quality definitions provide a detailed explanation of what a student must do to demonstrate a skill, proficiency or criterion in order to attain a particular level of achievement, for example poor, fair, good or excellent. Scoring strategies involve the use of a scale for interpreting achievement and translating it into a final grade.

Table 2 displays an example of a part of a rubric with just one criterion, regarding the authenticity, relevance, complexity and difficulty of the topic with respect to the challenge, specified in the left column. The other four columns contain descriptions of the performance of the team in terms of the selection of the project topic, differentiating between poor, fair, food and excellent accomplishments. The distinct descriptions have the role to guide students, offering hints on expectations and facilitating self-evaluation.

Criterion	Poor (Beginning)	Fair (Developing)	Good (Accomplished)	Excellent (Distinguished)
Project topic: Authenticity, relevance, complexity and difficulty of the topic with respect to the challenge	The topic proposed has a week connection to real-world problems and to the challenge posed in the driving question. The degree of complexity is modest and the difficulty is low requiring little effort to solve.	The topic proposed derives from real world problems and goals that are correlated with the challenge, but need more precision. The theme has a modest degree of complexity and is relatively simple, requiring a modest effort to solve.	The topic proposed derives from genuine problems and the goals set are precise, measurable, correlated with the challenge. The topic is complex, requiring careful gathering and analysis of information. The topic is demanding, exercising the learners' skills.	The topic proposed derives from a real world problem of high, current interest. The goals set are well correlated with the challenge in the driving question, not only precise and measurable, but also ambitious. The topic is complex, requiring rigorous and critical information and analysis. The task is difficult, requiring intense, sustained effort, in-depth knowledge and superior skills.

Table 2. Illustration of a rubric assessing the project topic chosen by the students, given a wider driving PBL question.

3.3 Plan the learning experience

The last phase of backward design is the planning of the learning experience and teaching activities (Wiggins and McTighe, 2011). At this

stage, the most effective teaching methods are selected, to actively involve students in the learning process. The criteria for choosing the didactic approaches must be correlated with the evaluation method established in the previous step.

The choice of the teaching method depends in an essential way on the willingness of the teacher to give away some of the control and the readiness of the students to assume a more active role and more responsibilities. For instance, Fig. 10 illustrates four types of inquiry ordered by the roles of the students/teachers (NRC, 2000; Banchi and Bell, 2008). In the case of confirmation inquiry, students confirm a principle through an activity when the results are known in advance, whereas for structured inquiry students investigate a teacher-presented question with no predetermined answer by means of a prescribed procedure. Guided inquiry stimulates students to investigate a challenge posed by the teacher, using procedures selected by themselves, and, in contrast, open inquiry encourages students to investigate questions that they formulate and use procedures that they choose.

Each method has its advantages and drawbacks, and may be useful in a given context. Any teacher aspires that the students become independent at some point, acting like scientists, deriving questions, designing and carrying out investigations, and communicating results. However, it may be advisable to only gradually increase their freedom,

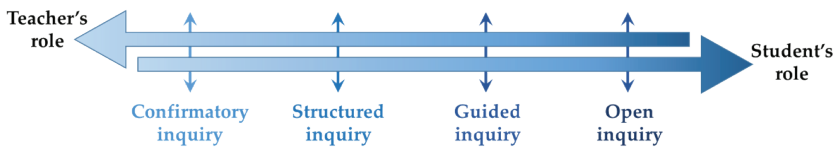

Figure 6. Various types of inquiry-based teaching methods ordered by increasing student role (based on NRC, 2000).

as they demonstrate their ability to manage it successfully. In the case of the training course on PBL, this gradual increase of freedom was devised by starting with simple exercises to understand the basic concepts and expectations and moving towards structured inquiry, when trainees look for solutions to an open problem posed by the trainer using the prescribed procedure of backward educational design and design thinking.

As backwards design is essentially a planning framework,

conceiving a great learning experience requires an additional approach, a method centered on how the students learn, think and feel. Choosing how to teach requires more than appropriate planning criteria. It entails empathy for the students and creativity, and this is where the Design Thinking approach (Lewrick et al., 2018) comes into play. The Design Thinking method focuses on the real needs and desires of the user, and its human-centered design principle can be easily transformed and applied to plan a student-centered learning experience.

Design thinking is a approach to for creative problem solving, which starts with the needs and aspirations of the user to generate, prototype and test solutions that satisfy those needs (IDEO, 2012). The design thinking process involves the sequence of steps mentioned in Fig. 2. The first step is to understand the challenge and select the users/beneficiaries. Completing this first step requires establishing learning needs, searching for and selecting credible sources for documentation, and reading them for thorough comprehension. The second step involves gathering information from the field by observing users, creating a profile of them through systematic empathy exercises. After the beneficiaries are well understood, in the third step, all findings gathered are evaluated, interpreted, and summarized into a point of view, which defines the problem, framing the design theme. The fourth stage starts with a divergent thinking exercise, in which ideas for solving the problem are generated, and ends with a convergent thinking step, when the optimal option is chosen. In the fifth stage the proposed solution is put into practice by developing a prototype and in the next stage, it is tested by obtaining feedback from users and evaluating the results. Depending on the results, the process can be resumed, from the beginning, or from another intermediate step, until the final test leads to a minimum viable product or service. In the end, reflection sets the ground for tackling the next challenge.

In the following, we illustrate the application of the design thinking approach (Lewrick et al., 2018) to the planning of a learning experience for teachers taking a training course on PBL. To be consistent, we considered that a class on project-based learning has to challenge the trainees to complete a project, working in teams.

3.3.1 Understand the problem. Observe the users. Define the design theme.

To understand the problem, the teachers can start from the challenges their students faced in the past (or may face, for new courses)

in developing competencies on the topic to be covered by PBL. The trainees can attempt to answer questions such as: What is the muddiest point for that unit? What concepts are most difficult to grasp? What are the weak points of the previous teaching approach? What was missing in the previous learning experience?

To plan our training course, we tried to identify the needs of our target group, consisting of academics of different backgrounds (from social sciences to medical and life sciences, from applied sciences and engineering to humanities and arts) and different positions and levels of experience (from lecturers to readers and professors). We found out that their experience with PBL was very diverse but the pedagogical fundamentals needed to be strengthened and the design skills had to be practiced.

The second step is to observe the students, to watch the way they think, learn, react emotionally, etc. Asking students questions we may find that they feel a motivation to learn if the topic is relevant to them, authentic, likely to be useful in the future. We may also discover that students learn more easily if they start from simple to complex (not directly with the most general case) and discover by themselves the rules and the general conclusions. Observing students, we may realize that they appreciate a learning experience that satisfies them emotionally, in terms of social interaction, increased self-esteem and self-confidence.

Some of the general observations mentioned above for students may also apply to adult learners, particularly to the target group of the PBL training course. Some difficulties may arise from the differences between the target group members, in terms of experience with PBL, background, seniority etc. Such differences may lead to anxiety to some and pride to others, shame and hopelessness to some, boredom to others.

Defining the design theme is the third step. It clarifies the goal, using action verbs and information about the context, stressing the needs of the users. A possible structure of a design theme for planning a learning experience may be the following: "Students need a way to … (*learning outcome*), such that they overcome … (*learning difficulties*) and feel motivated and connected, and experience self-esteem". Such a formulation of the design theme leads to a rethinking of the pedagogical approach.

To be consistent with our principles, we formulated a design theme for our PBL training course that followed the typical structure but was adapted to our specificity. The statement was the following: "Trainees

need a way to learn how to design a PBL unit with a practical, hands-on approach, such that they overcome some gaps in their pedagogical background without stressing too much educational rigor, to the extent that they feel engaged, connected and confident, despite the significant differences among them."

3.3.2 Ideate

Ideation is the fourth stage of the design thinking process, in which solutions are generated, typically by some brainstorming exercise. In the case of our PBL training course, the framework was already clearly set, as project-based learning has been extensively applied (Larmer et al., 2015). The success in applying the PBL, a teaching/learning method in which students acquire skills by actively engaging in a project on relevant, real-world topics, is closely related to the quality of the challenge (driving question) proposed, the degree of collaboration between the learners and the way the assessment is done.

PBL design starts with a careful selection of the challenge, as the proposed topic must be authentic, stimulating, relevant, and open (HQ PBL, 2018, McTighe and Wiggins, 2013). A topic is authentic if it is related to a real-world problem and stimulating if it intellectually challenges learners, encouraging them to develop their knowledge, skills and attitudes. The relevance of the driving question can be understood from two perspectives, that of the teacher, in the sense that it is aligned with the objectives of the course, and that of the learner, whose interest must be aroused. Generally, authentic themes are also open, with multiple solutions possible, each with its own advantages and disadvantages.

PBL implementation requires strong collaboration, founded on tenacious investigation (HQ PBL, 2018). Collaboration involves effective teamwork, based on communication, planning, organizing and implementing activities in which all members participate. Collaboration also involves the prevention or resolution of potential conflicts, and includes the creation of a climate of trust. In addition, in the case of entrepreneurship, the interaction with potential customers, with the beneficiaries of the respective products or services and with various stakeholders is essential.

PBL assessment must be complex and involve learners (HQ PBL, 2018). The complexity is related to the use of various multi-criterial approaches, which combine the observation of progress with the evaluation of the competencies acquired at the end. The assessment criteria

must be diverse, referring not only to knowledge, but also to skills and attitudes. It is preferable if the assessment reflects diverse opinions, combining self-evaluations with assessments formulated by teammates, by peers from other teams, and by the instructor. All these evaluations will be based on standards that specify the degree of achievement of the competence, from unsatisfactory to excellent.

In the case of our PBL training course, the challenge posed to the trainees was to work in a transdisciplinary team to design a PBL unit that could be delivered collaboratively. The challenge passes the criteria for authenticity, relevance, and openness, also being stimulating, whereas the implementation is strongly collaborative. The assessment is multi-criterial and based on clearly formulated rubrics.

To generate ideas for our PBL training course we brainstormed on the choice of examples, on the suitable sequence of topics, on the selection of teaching materials used, on the digital tools to be used, etc. Correspondingly, we did brainstorming exercises to generate the most appropriate questions, exercises, homework assignments as well as to formulate suitable rubrics to evaluate performance and the results of the project. Each divergent thinking stage, in which ideas were generated, was followed by a convergent thinking phase, in which the best ideas were selected, based on various criteria, typical examples being feasibility and impact.

To stimulate engagement and to address the emotional dimension of education (Harmin and Toth, 2006), we combined moments of individual reflection with conversations in teams and plenary discussions. We had in mind various exercises meant to establish a climate of participation, trust, and cooperation. The key messages were that it is natural to make mistakes while learning, it pays to ask for help, and that taking risks can lead to greater accomplishments.

3.3.3 Prototype

The fifth stage of design thinking is prototyping, which allows the implementation of the solutions proposed in the ideation stage. Given the well known and tested structure of a PBL unit, the Design Thinking approach was useful particularly in planning the learning experience. The steps in PBL have been extensively discussed (Larmer et al., 2015). Typically, they consist of a sequence that includes: i) announcing the challenge, ii) forming teams and choosing specific project topics, iii) establishing learning needs and information sources, iv) planning activ-

ities, assigning responsibilities, v) carrying out activities, vi) analysis and interpretation of results, vii) presentation of results and evaluation.

First and foremost, we decided to hold the classes face-to-face as much as we could, using a co-working space with high flexibility, which could be reconfigured for plenary, team and individual activities. For some activities we also used an online learning platform, with synchronous activities held with the entire class or in teams, in breakout rooms. The class materials and the independent work of the teams were hosted by the same online platform.

Consistent with the backward design philosophy, we started our PBL training course with an exercise meant to build interest and motivate the learners. We used a set of questions posed online through poll platforms to inquire in real time about good teaching practices, about what was being done and what needed to be improved. We continued with stating the final goals and learning outcomes. We announced the challenge as well as the path we proposed for reaching the goals and stopped for a moment of reflection, in which the trainees expressed their opinions and desires. Acknowledging that the challenge is complex and difficult offered them a chance to express worries and fears, as a ground zero for building trust and confidence.

To facilitate the formation and self-organization of teams, we carried out icebreaking exercise for the trainees to get acquainted with one another. A first example is Name-Adjective, which facilitates the retention of names, as each trainee chooses a characteristic word to accompany his/her first name, provided that it starts with the same letter. Another useful discovery game is Six+Six, where trainees give an example of their likes and dislikes about four topics, such as songs, sports, food and animals, and express opinions on two topics, such as the status of teaching and learning in the university and what they are willing to do to change it. Finally, another exercise we recommend is Shared & Unique (All & One), where trainees discuss in groups to discover what they have in common and what they have special or different and then describe their conclusions to the entire class.

To assist the trainees in choosing a specific project topic we had in mind two exercises. The first, the Lightning Interview, gives all learners the chance to talk to everyone else by taking turns to discuss in pairs their personal interests in the field, for a maximum of 2 minutes. Although effective, the exercise is time consuming. A faster option would be to mimic the sports drawing. One can start by establishing series heads, who propose first versions of specific project topics, the other trainees

joining the teams, based on their affinities. Fine adjustments were made at the end, as some teams were unbalanced.

The teams gathered to discuss the challenge and choose the specific topic of their project. The freedom of choice, as well as the responsibility for the decision made, belonged to the learners. Along with freedom came the responsibility, as the assessments include a criterion referring to the authenticity, relevance, complexity and difficulty of the topic chosen.

Next the trainees were asked to reflect on the knowledge and skills useful in approaching the topic. Alternating moment of individual reflection and team discussions the learners established learning needs and the sources for information. By asking each team to share their thoughts, all trainees were exposed to various opinions and different approaches.

The teaching/learning activities mixed classwork, teamwork and individual study. During the meetings two types of undertakings took place, one focusing on the understanding of fundamental educational concepts, the other concentrating on monitoring team work and progress. Various exercises allowed trainees to strengthen their knowledge of competencies and their levels of complexity (Bloom's taxonomy), the deliverable being the learning outcomes of their PBL unit, ranked by importance. The second deliverable consisted of a set of evaluation rubrics, to perform a complex assessment of student and team performance. The rubrics were formulated during teamwork meetings, held subsequent to plenary sessions in which various examples and exercises deepened understanding and facilitated exchanges of ideas. The third deliverable consisted of a plan describing the learning experience for the PBL unit. The plans were drafted by each team, following classwork on PBL fundamentals. The exercises started from an review of active learning methods and on overview of the project-based approach. The focus was on stating the challenge, as formulating a good driving question is one of the most important parts of the PBL effort.

While the learning process was progressing and the key concepts were gradually being understood, the teams also spent time on planning their homework activities, assigning roles and responsibilities, setting milestones and deadlines for deliverables etc. The self-management of the teams was regularly monitored by the trainers, to prevent crises and ensure that progress was being made.

The last part of the course included some Design Thinking exercises, devised to stimulate the trainees to empathize with their students

and to foster ideation and decision-making, while attempting to plan the learning experience. For instance, building an empathy map, which captures what students think, feel, need, and desire, what they say and what they do is a powerful exercise.

Additionally, brainstorming exercises consisted of divergent thinking phases, in which all the learners worked first individually and then in teams to communicate the ideas generated. Guiding the trainees, we made efforts to ensure that no idea was rejected and the critical remarks were discouraged, as any misplaced irony can inhibit the more introverted members. Less inspired ideas are eliminated naturally, without any negative affective charge, in the phases of convergent thinking that immediately followed. Convergence was done in two steps, one of clustering related or similar ideas and one of ranking them according to criteria accepted by all team members. The divergent/convergent thinking exercises were used to generate and select ideas for an engaging and emotionally fulfilling learning experience.

To encourage the expression of all ideas, no matter how 'crazy' they seemed, we consistently encouraged the learners to avoid formulations such as 'yes, but …' and embrace 'yes, and …'. To foster a climate of trust and creative effervescence we used ice-breaking activities and warm-up exercises. If the interaction would begin with difficulty and awkward moments of silence, we started with simple questions, which everyone could answer. Gradually we would move to questions that allow multiple answers, to stimulate a free exchange of ideas, making space for all opinions. We tried to give some partial credit to incomplete or imperfect responses to encourage sharing and risk taking, to cultivate self-correction by learning from mistakes.

3.3.4 Test and evaluate

The 'prototype' was the final deliverable of the project, combining all three partial results: the learning outcomes, the assessment rubrics and the unit plan. The testing of the prototype was done during the final presentation of the plan for the PBL unit. Each team defended their plans in front of all others, benefiting from the fact that the peers were teachers with similar interest in pedagogical innovation. Further testing took place after the completion of the training course in selected classes, in real life conditions. Ideally, a methodologically rigorous pedagogical research, which includes both experimental and control groups and both ex-ante and ex-post testing, to statistically measure differences in

student progress. Depending on the results of the prototype testing, the pedagogical design process can be resumed until the desired degree of didactic effectiveness and the proposed degree of student satisfaction are reached.

3.4 Implementation

We provided during the previous sections various details regarding the implementation of the class, particularly related to the choices for learning outcomes, assessment instruments and learning experience. In the following, we describe the organization of the course, which was delivered over 10 weeks as in the spring of 2022.

To form a balanced target group, we announced the course to wide audiences, of diverse backgrounds. The announcement was delivered through faculties, web pages and social media channels. To make a selection we asked applicants to answer a few questions that checked their availability, their motivation for attending the course and their expectations. The target group consisted of academics from social sciences, 7, medical and life sciences, 5, applied sciences and engineering, 2, and humanities and arts, 3. The group was completed by 5 colleagues with higher expertise in education, who were the first drafts in setting up the teams. The 22 academics had diverse positions: 3 assistant lecturers, 11 lecturers, 6 readers, and 2 professors.

The classes were held mostly face-to-face in a co-working space with multiple functionalities, as the furniture can be easily rearranged for holding lectures and conference presentations as well as workshops and teamwork sessions for up to 30 people.

The five teams proposed different topics for the PBL unit, a significant challenge being to find the common ground for collaborative units for students in different fields. With themes of recent interest, such as sustainability, climate change, health and well being, cultural diversity, or energy sources, the trainees were able to find sufficient overlap between classes in different fields of study. The teams formulated some common learning outcomes, which addressed all types of classes, as well as specific learning outcomes, which were tailored to each discipline. For instance, a PBL unit on sustainability conceived for a collaborative class involving students in economics, biology and theology had both shared learning outcomes (focusing on knowledge of basic concepts of sustainability, as well as common soft skills and attitudes and values) and customized learning outcomes, emphasizing field-spe-

cific aspects (for instance cost analysis, biodiversity, and religious community awareness, respectively).

The main obstacles witnessed by the trainees included a 'steep learning curve', 'difficulties in choosing good driving questions', 'time consuming effort', 'insufficient institutional rewards and recognition', 'insufficient community or peer support', 'potential for failure' etc. During the subsequent implementation of the PBL units, additional difficulties were identified, examples being 'inconsistent student participation', 'dysfunctional teams', 'class management problems', 'quality of deliverables', 'overgenerous assessments' etc.

In the end, the training course evaluations showed that the class was considered interesting, challenging and useful. The follow-up sessions were also useful, providing the academics with a chance to share experience and learn from each other. Despite the complexity of the design and the difficulty in the implementation of PBL units, overall, the target group recognized that the method engages students, stirring latent energies unseen during the traditional teaching activities.

Conclusion

We reported our experience in planning and implementing a training course on PBL offered to university teaching staff interested in using project-based learning in their courses. We showed how we combined Backward Educational Design and Design Thinking to devise a learning experience that carefully takes into account the emotional dimension of learning. Our approach was based on five simple principles: *i*) Focus on students! *ii*) Begin with the end in mind! *iii*) Show don't tell! *iv*) Foster radical collaboration! and *v*) Walk the talk!

Starting backwards, with the final goals in mind, we proposed learning outcomes, with a modern perspective on competencies and making use of Bloom's taxonomy. We ranked the learning outcomes as essential, important and secondary, and indicated possible correlations between them and various types of assessment methods. In the last step of backward design, we followed the Design Thinking approach to plan a learner-centered educational experience.

The implementation combined individual, team and class activities, emphasizing reflection, communication and collaboration. We alternated moments of divergent thinking, to generate ideas, and convergent thinking, to choose the optimal solution. In promoting PBL methods, we

advocated for authentic, stimulating, relevant, and open challenges, for implementation through strong collaboration, founded on tenacious investigation, and for assessments that are diverse, complex and involve learners.

Our goal was to provide some guidance for academics interested in drawing effective PBL units by emphasizing the practical design aspects. We hope that the present work could be a useful instrument, illustrating how backward design and design thinking can be combined to plan memorable learning experiences for our students.

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5

PBL in Higher Education: RESTART4EDU Proposal for Practice

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CHAPTER 5

PBL in Higher Education: RESTART4EDU Proposal for Practice

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1. Introduction

The demands of the Covid-19 in the higher education setting accelerated teachers' training, presentation, and discussion of cases, as well as mentoring. These were the basic principles of the RESTART4EDU project, which occurred in two phases: first, to create the space and context for teachers' reflection about teaching practices, learning and preparation to implement Project-Based Learning (PBL), relying on a previous assessment of needs (Oliveira et al., 2022); second, after having implemented what was learned with the support of mentors, to reflect and improve in a summer school with other colleagues in a collaborative learning experience and with the use of a supportive platform (Dias et al., 2022).

With this chapter, in the broad context of the higher education challenges we are currently facing and that were highlighted in the first chapter

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of the book, we aim to explore the basic principles of PBL, but especially how teachers can develop, implement and manage PBL projects in their courses. This way, the present chapter aims to present basic elements of the history of PBL in higher education, considering best practices for its design and implementation. In a second moment, we aim to present specific suggestions to promote PBL in higher education classes. Hence, some theoretical considerations, but also specific examples will be presented to support the development of new projects. The following pages of this chapter are dedicated to the important role of transversal skills, also called 21st century skills, and group collaboration. These are essential elements of PBL that should be considered before establishing the element of evaluation. In the last pages of the chapter, attention will be dedicated to digital tools that can support PBL implementation and management.

2. Project-Based Learning in Higher Education: History and its Essential Elements

Writing the history of a teaching methodology is a considerable challenge. It implies a review of authors, a research work with some subjectivity, in the search for a common thread to understand the path that allowed us to reach the present day. In the following timeline we try to summarize our review based on some seminal and inspiring works from ancient philosophers until contemporary perspectives and approaches (figure 1).

Trying to go as far back as possible in time, in the literature review, many authors cite the contributions of Confucius, Aristotle or Socrates

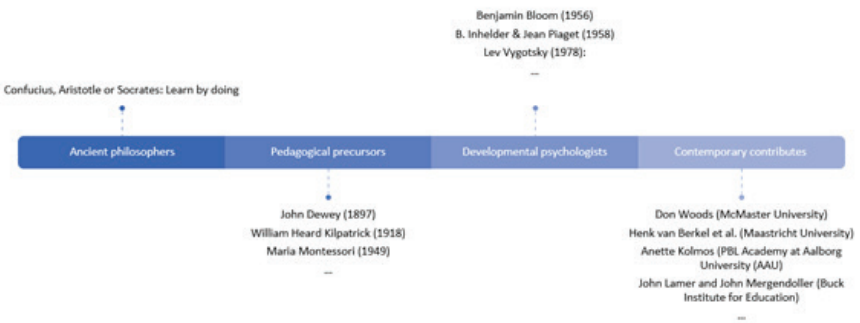


Figure 1. A brief history of PBL.

to value the importance of an active role of the student, and of learning by doing. Confucius, a Chinese philosopher, teacher, and politician who greatly influenced the East Asian civilization (5th – 6th century BC), is famous by the expression "I hear, and I forget. I see and I remember. I do and I understand". Later, in the Nicomachean Ethics, 350 B.C., Aristotle refers that "For the things we have to learn before we can do them, we learn by doing them" and he goes on, exemplifying that men become builders by building, learn to be brave by doing acts of bravery, etc. Also, to Socrates, a philosopher that is well-known by different teaching methods, based on questioning and inquiring, is attributed a quotation: "Education is the kindling of a flame, not the filling of a vessel". In common, these contributions bring a criticism to a teacher's role as an information provider, and a stimulus to promote active learning.

This emphasis in putting students in the center of the learning process, considering an active role, is repeatedly associated to John Dewey that, for example in "My Pedagogic Creed" (Dewey & Small, 1897) states that "the only true education comes through the stimulation of the child's powers by the demands of the social situations in which he finds himself" (p. 77). Not only did the author emphasize a student-centered approach, as also related learning with the context that students are in. One of his students, William Heard Kilpatrick is probably one of the first authors to explicitly identify this expression in the paper "The project method" (1918), in which he defends that students should be involved in purposeful and meaningful activities by the mean of projects. And he discusses about different kind of projects that could be put in place, the advantages and limitations to foster students' motivation, to decide purposes that they wanted to pursue, etc. A perspective that reminds us of the democratic experiences of Alexander Sunder Neill (1945) but was criticized by Dewey, as example, for the risk of "muddle and mess" (Dewey, 1916, p. 205), and ended up not having much attention or consequences in an enduring change in pedagogical experiences. Higher impact was achieved by the Italian pedagogue Maria Montessori (1949) with "The absorbent mind", that constituted a significative contribution to promote experiential learning. Despite being associated with early childhood education, her work was determinant to value the role of active learning, but also the role of cognitive and socio-emotional development in children's learning. With the development of psychology and developmental sciences, the knowledge about learning and how to promote it faced a significant growth. Bärbel Inhelder and Jean Piaget (1958), with *The Growth of Logical Thinking from Childhood*

to Adolescence highlight the determinant role of the active learner to cognitive development, learning by discovery and offer the foundational elements underlying the development of constructivist theories of learning. Another important contribution emerged with the works of Lev Vygotsky (1978), "Mind in society", highlighting the relationships between cognitive process and social activities, and the determinant role of current developmental level (proximal development) and the support of adults, parents and teachers, as well as peers in cognitive development. In fact, the constructivist theory constituted a qualitative leap, changing the way of understanding the nature of knowledge and, consequently, the teaching and teachers' practices (Coll, et al., 2004). One of the major outcomes from this progress is a student-centered classroom and a teaching and learning approach essentially oriented to the process, *rather than the final products* (Applebee, 1993). A second major implication is the opportunity for teachers to "redefine the nature of learning and, in turn, reposition their roles in teaching from a knowledge/information transmitter to a learning/thinking process facilitator" (Hung et al., 2008, p. 493). Without minimizing the role of the so-called "hard skills" (technical and theoretical knowledge and competencies), the approach values the mobilization of the so-called "soft skills" such as collaboration, problem solving, autonomous learning, planning and task management (e.g., Ravitz et al., 2012; Schmidt, Van der Molen et al., 2009; Strobel & van Barneveld, 2009).

Despite these contributions and the challenge that the Bologna Process has posed to foster students' competences, the most common perception is of little change in the teaching methodologies of teachers in Higher Education. Still, some examples illustrating the possibility of change can be found in higher education institutions. Based on a problem-based learning perspective, an important contribution was performed in the 1960s by Don Woods in the Chemical Engineering course at the McMaster University (web), that spread rapidly to the McMaster's medical school (Dirckinck-Holmfeld, 2009). This movement inspired other medical schools, such as the ones in Maastricht (web) or in Aalborg (web) (Davies et al., 2011). Particularly in Aalborg University, the PBL Academy promotes an international journal and conferences dedicated to the subject, despite reflecting between problem and project-based learning. Also, primary and secondary schools adopted this methodology, among which the Buck Institute for Education is one of the most proeminent institutions (web).

Despite the need to clarifying the concept between problem and project based learning, its important to state that the first one is more focused on the knowledge and the product to be achieved by the solution to the problem proposed, while the latter is more focused on the process of the analysis, development and presentation of a creative and critical artifact (Barge, 2010). In problem-based learning, activities are driven by an open-ended question that might be answered, focusing on a solution for the problem or answer to the question, and is mostly oriented to the acquisition of new knowledge or focused on the product. On the other side, Project-Based Learning is based in an assignment that demands or allows multiple possible solutions. This way, it focuses on a problem analysis and solution(s) generation, with more emphasis on the process of generation of those explanations or solutions. In the RESTART4EDU project, we assumed a perspective that is more aligned with the Buck Institute for Education. Despite their experience in K-12 courses, the experience and reflection constitute a significative background for our pratice. Apart of the implication for students and teachers' roles in the classrooms, it implies strong beliefs about the role of education in the promotion of students' skills. If many teachers assume they perform projects in their classrooms (Dias, Mergendoller & Bastos, 2014), it is important to clarify the methodological principles for a successful application of project-based learning.

Considering the experience and reflection produced by the Buck Institute for Education (2019), seven essential elements should be considered:

1. Challenging problem or question – Students are presented a meaningful and challenging scenario with questions, problems, statistics, etc. to drive the project development.
2. Sustained inquiry – Students are involved in an in-depth inquisitive process that is maintained over time, doing new questions, finding (re)sources and applying information.
3. Authenticity – More than meaningful, learning experiences should involve real-world experiences relevant to students' knowledge, concerns, interests and skill development.
4. Student voice and choice – Students are involved in the development of projects, with voice and choice in decision making (depending on the grade level and type of project).
5. Reflection – This is a central component of project development, with students and teachers discussing the process and the product of the

project, effectiveness, quality of work, obstacles and strategies to overcome them.

6. Critique and revision – Teachers and students are involved in a continuous interaction, presenting their inputs, receiving feedback and improving their process and products.
7. Public product – Projects are presented to public, sharing, explaining and celebrating what was learned to the broadest possible audience.

If these principles are clear, it is important to understand that first attempts are usually a difficult task, and the development of meaningful and effective projects demands reflection and improvement.

3. From Principles to Practice: How to Start?

We must have in mind that good projects don't happen by chance, and particularly for the first time, they are a challenge. Despite the difficulties in the transition from a traditional learning approach to PBL, researchers highlight the positive impact for teachers and how the new roles, the proximity and the positive relationship with students can foster their motivation and skills (Bureau et al., 2022; Habók, & Nagy, 2016; Ribeiro, 2011). It implies also the importance of training and adequate planning to ensure its correct implementation (e.g., Boss & Krauss, 2018; de la Torre-Neches et al., 2020), having in mind that: it is determinant to promote curiosity and involvement in the task, creating and authentic and challenging scenario; defining an appealing and creative driving question, considering the learning objectives of the course; give students freedom and responsibility to participate in the different phases of the project; organize the project to promote the "21st century skills" such as collaboration, critical thinking, use of ICT…; promote an inquisitive spirit, raising new questions to allow students for deeper knowledge, learning and creativity; maintain continuous feedback, in order to monitoring and reviewing students' work; ending the project with a public presentation to a real audience.

In this context, we should have in mind what students should know in the end of the project, considering the aims and the syllabus of the course. With the end in mind, authentic questions should be presented to engage students, allowing them to have voice and choice in the planning and in application of the project, consistent with particular interests that might be relevant for the community, the broader social context or the theoretical discussion. This implies a different organization of time and

space in the classroom, organizing activities that, in many cases, might be very close to professional activities, in a secure, authentic and empathetic climate of the classroom.

Similar to a research project that academics perform, in project based-learning planning should start with a driving question. Based in a challenging context, with epidemiologic data, relevant breaking news, a discovery from a published paper, interesting and provocative questions should be presented to engage students. They are usually driven to explore different arguable standpoints (e.g., Is there inclusion in the schools? What are the best policies to promote welfare?) or to promote answers to a problem / develop new products or solutions (e.g., How to promote inclusion in schools? How can we contribute to promote sustainable behaviors in our university/ city?). Similarly to what happens in academic research, also in project-based learning this one of the most difficult moments of project development and we should try to understand how it might be implemented, pros and cons, but also if it would be possible to improve it to maximize, as much as possible, opportunities for learning and development. Usually, good questions are not attained in their first version. This way, a first draft might be developed to be revised, criticized and enriched. Teachers should afford also students the possibility to go as deep as possible into a given topic (a complex issue, big ideas) and that might be able to be translated into practice. Some examples are presented in the following table (table 1).

Traditional questions	PBL adjusted questions
What is global warming?	Do we need to worry about global warming in our city?
What were the most popular learning theories in the XXth century?	How have learning theories changed in the XXth century?
Define what is bullying? And who are different intervenient?	How can we reduce bullying?
What is programming?	How can programming be useful for each person and for the society?
Define public health.	How can each of us contribute to public health?

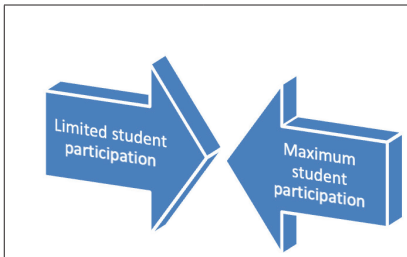
Table 1. Refining driving questions to PBL.

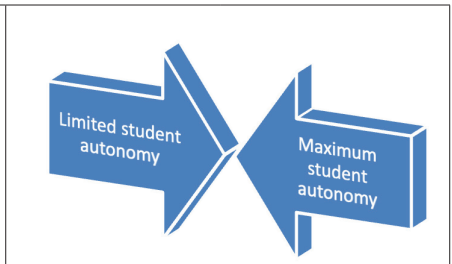
To launch the driving question, is important to create a scenario. Teachers can search and discuss for scientific or newspapers articles, topical issues, epidemiological studies, relevant news, reflections with peers, according to the syllabus of the course. Exploring contacts from/

with the community and link the project to local or national, professional or academic events, valuing the connection with the community promotes students' engagement and motivation. A synthesis of complexity that teachers can reflect in the planning of the project might also consider:

- the time for the project, from one to two weeks to a semester or school year;
- if they are disciplinary and related to a course or interdisciplinary or considering multiple courses;
- if they use limited or extensive technology;
- if the project is developed only at the school of classroom context or in the community;
- if they involve only the teachers and students of the course or they are open to multiple teachers and community members;
- and if the presentation of its results is performed to the class or school or a broader community or experts.

Also in their dynamics, references in the literature allow us to understand different level of teachers and students' participation and autonomy. Naturally that more autonomy tends to be achieved with higher levels of experience of both teachers and students.





Teacher selects an issue	**Students selects an issue**	**Teacher defines products and activities**	**Students define products and activities**
Teacher defines learning outcomes	Teacher and students negotiate learning outcomes	Teacher controls project schedule and pace	Students determine timeline and pace of the project
...	...	...	...

Table 2. Teachers and students' participation and autonomy.

Engaging students in heterogeneous groups, creating opportunities for skills development with the use of accurate evaluation tools and technological support must be planned. However, teachers planning is determinant to define students' participation, with teachers defining or negotiating the learning outcomes, and autonomy, with teachers' controlling the schedule and timelines or also negotiating the pace of the project with students. Also, the definition of standards about what students should learn should be addressed, considering also the way they should present the results of their project, incorporating simultaneous results as the domain of ICTs, formatting style, etc. The success of the project depends on clear aims and sound assessment practices. This way, a synthesis of these issues is presented in the following table (table 3).

What should students learn / be able to do?	**How might students present their learning / skills?**
Define the criteria for measuring results (disciplinary knowledge, skills, goals...?)	Self-assessment methods are used?
What work requirements are students expected to complete?	Content (objectives of the course) and Process (such as cooperation, communication, problem solving and teamwork) are planned?
Students are involved in reviewing or determining the project benchmarks?	Multiple indicators are predicted (for greater equity among students)?
Students prepare a final exhibition that demonstrates their ability to apply what they have learned?	Evaluation includes formative and summative assessments?
...	...

Table 3. Teachers and students' participation and autonomy.

It is important, then, to:

- Identify end products for a project;
- Use multiple deliverables and a system of checkpoints (milestones);
- Use artifacts – evidence of the process of student learning – to assess skills and learning (debates, presentations, reports...). Examples are presented in the following table (table 4).

Written products	Presentation products	Technology Products	Media Products	Others
Research Report Narrative Letter Poster Summary Prose/ Poem Sketch, Brochure / Flyer Survey Essay, Book Review ...	Speech Debate Play Music/lyrics Round table discussion Discussion Dance Presentation Exhibitions ...	Databases Computer Illustration Computer program DVD Internet website ...	Audio or video recording PPT presentation Drawing Painting Sculpture Collage Map Album ...	...

Table 4. Evaluation artifacts.

To support teachers to develop their first project-based learning scenario, the reader is invited to develop a first draft of the project in order to transfer their learning into a concrete project proposal. Using the presented information, the following tables can help higher education teachers to plan a PBL and to discuss with peers and colleagues.

4. The 21st Century Skills and Group Collaboration

Another important element of PBL is the promotion of 21st century skills; this is a cornerstone for project design and development; and group collaboration can be conceived of a catalyst. PBL represent a different approach to promote learning and development. Without questioning the role of knowledge and the so-called "hard-skills" in teaching and learning, PBL assumes the central role of soft, socioemotional or transversal skills (UNESCO, 2020), also designated or 21 century skills (Bell, 2010; Mergendoller et al., 2006; Ravitz et al., 2012).

In this context, several typologies of soft skills have been proposed. Binkley et al. (2012) propose a set of skills, such as Creativity and innovation, critical thinking/problem solving/decision making, learning to learn/metacognition, communication, collaboration (teamwork), information literacy, ICT literacy, citizenship (local and global), life and career skills, and personal and social responsibility (cultural awareness and competence).In the tradition of the Buck Institute for Education,

four particular skills are highlighted, such as critical thinking, communication, collaboration and creativity (Mergendoller et al., 2006; Ravitz et al., 2012). And some implications for teachers' practice, but also for measurement and research, have been developed. One of the contributions was presented by Sondergeld and Johnson (2019) in a set of dimensions, such as Creativity & Innovation (A), Critical thinking & problem solving (B), Communication, collaboration, social and cross-cultural awareness (C), Information, media, and technological literacy (D), Flexibility, adaptability, initiative and self-direction (E), Productivity, accountability, leadership and responsibility (F). Based on qualitative and quantitative analysis, results suggest the validity and reliability of this proposal and inherent measure, thus holding potential of application to practice.

Though an authentic challenge and provocative driving question, students must be involved in an autonomous learning pathway, with the supervision and support of teachers. With the projects, social and emotional skills will be promoted, particularly related to communication, collaboration and problem solving. With the projects, through individual and peer learning and the use of technologies as tools to engage students, they will have the opportunity to develop their skills and human development. There are intentional programs to promote these set of skills (e.g, Partnership for 21st Century Learning P21; Life Skills and Citizenship – UNICEF; Collaborative for Academic, Social, and Emotional Learning – CASEL) but PBL aims to promotes these skills while students are learning, as part of the regular teaching and learning methodology. This impact is positive for both students and teachers (Oliveira et al., 2021).

It implies, then, a new perspective of the classroom, a set of beliefs and attitudes, management of the time and activities to promote interaction between students and between teacher and students. It implies, more than a task to be developed in group, a real spirit of collaboration in the classroom. Based on the principle of collaboration, some recommendations are determinant:

- groups should be constituted around four elements to allow multiple opportunities for knowledge sharing and interaction;
- the organization of the groups should be performed by the teacher before launching the project, according to the learning objectives;
- groups should be heterogeneous, considering the students' characteristics and the individual contribution;

Create your first project-based learning scenario.

Name:	
Institution:	
Grade level:	
Course:	
Name of the Project:	

Define the driving question? (more exploratory or directed to a problem or solution)	-
Reflect about the possible pros (what will allow students to learn) **and cons** (possible obstacles)	+ + - -

How would you engage students in the project?

Describe the scenario to challenge students to the PBL in 50 words:

What is the scope of the project?

Length (one to two weeks; ...)	
Amplitude (one issue of a course; ...)	
Technology use	
Range (will be performed in the classroom; ...)	
People involved (teacher; community; ...)	
Audience (class; school; community; ...)	

What should students learn / be able to do?

Describe the learning outcomes and skills in 50 words:

How can such learning and skills be evaluated?

Describe the learning outcomes and skills in 50 words:

Are there simultaneous results?

Describe in 50 words:

- specific roles for students in the group might be assigned.

The seminal work from Kurt Lewin motivated sound research about group dynamics and group work. Belbin (1926), as an example, presents nine team roles: Planner, Monitor Evaluator and Specialist, and Shaper, Implementer and Finisher (more information on https://www.belbin.com/). However, more than focusing on the roles played by each team member, an authentic collaboration must be promoted. Meta-analysis supports that cooperative learning increases students' efforts to achieve, encourages positive relationships, and improves psychological health and wellbeing in higher education (Johnson et al., 2008; Johnson et al., 2014). Students learn from their interaction; they collaborate and negotiate, as they evaluate their own projects, efforts, motivations, interests, and productivity levels. Students become critical friends by giving constructive feedback to each other, which helps them become aware of their own strengths and improve on their interactions with each other.

5. Evaluation in PBL

It is generally accepted that teacher's effect on students' performance is significant (e.g., Chaudhary & Singh, 2022). In the literature, we found a large number of studies confirming that claim. Most studies highlight the role of school socioeconomic status, out-of-school activities, school's academic press, instructional practices and classroom climate as the most effective school variables (Holzberger et al., 2020), however, considering instructional practices and classroom climate, they become the second higher predictor. In the same line, previous meta-analysis studies found that factors related to curriculum and teaching were the stronger predictors of students' achievement and school effectiveness (Scheerens et al., 2013). Some studies suggest that the effect is greater in lower socio-economic classes (Nye et al., 2004). And this difference can be verified from an earlier age. Taylor et al. (2010), with 280 monozygotic twins and 526 dizygotic twins, found significant differences in student achievement. This is, teacher's quality moderated the genetic effects on early reading, particularly the oral reading fluency was related to the teacher's quality. In a review of more than 800 meta-analyses on achievement, John Hattie (2009) reinforced that teachers can make a difference, considering the involvement with

school bodies, but also discussing (sharing) their beliefs and conceptions about teaching and learning. Discussing what is best to teach next, which materials to choose, how to keep students engaged in learning, exploring activities that generate the most interest or optimizing challenges for learning is important.

As a classical text from Perrenoud (2000) claimed, it is important to break the traditional pedagogy in which we teach the same lesson and the same exercises for everyone at the same time. This can be performed considering the learning context and processes, as well as the products. Having explored how project-based learning can make a difference in the learning context and processes, it is important to explore how assessment can make a difference. It is well known that assessment has an impact on teachers and students, not only in their emotions (Myyry et al., 2020; Pekrun & Stephens, 2012) but also in values, social control and classroom management (James & Pedder, 2006).

Considering the exceptional role of assessment in teaching and learning (Baird et al., 2017), it is important to reflect on traditional methodologies. Particularly, test-based evaluations emerge in an era of accountability and competition between institutions with controversial consequences (Sahlberg, 2010). In this context, the authors' claims could be organized into the following typology:

- *Content-centered*: the curricula are understood as a list of subjects and contents to be taught and the assessment should be based on a test that integrates samples of representative content in that universe. The validity of that tool is related to the representative nature of the items, the average position and the dispersion of results, considering the shape of the distribution.
- *Objective-oriented practices*: originated in behaviourism, it defends the paradigm of "mastery pedagogy" with pedagogical practices assuming a "tree of objectives" where general objectives are fixed, broken down into increasingly specific and operational objectives. The curricula provide guidance on the tree and orient the sequences to be executed in the teaching process, based on prerequisites or learning accomplished previously. Assessment consists then in taking a representative sample of specific and operational objectives and constructing a sample of questions that best translate the sample of objectives. The correction criteria are no longer focused on the amount of information present in the answer but on the indicators of the selected objectives.
- *Conceptual networks practices*: Assume that the learning objective is essentially at the order of declarative knowledge, expressed in the form

of precisely defined, related and hierarchical concepts. This way, teachers should select and analyze the relationship between pairs of concepts, presenting an incomplete conceptual framework, asking to fill in the gaps, or questioning the student from the most globalizing concept to test understanding.

- *Activity-centred practices*: are focused on activities that can be generated through a given subject matter. Teachers should choose a sample of activities for students to perform, being close to skills or problem-based assessment.
- *Skills-based practices*. Skills are understood as abilities to mobilize resources (cognitive, affective, relational…) to accomplish tasks or solve problematic situations. It involves, then, identifying problematic situations or acts or situations that allow the student to learn and evaluate.

The reflection about these different assessment methodologies is important, once each involves a different level of learning depth, conservation (short or long term), the interest aroused (short or long term), internalization of the effects of the learning, degree of transfer or integration of acquisitions. Suggestions of questions, for the audience and for groups, are presented in the following table (table 5).

for the audience	for groups
What to expect, ask questions, comments...	Can you explain in other words? Can you give me some analogy...?
If time is limited, use inform signs	How could I explain it in greater detail? Can you give me an example of how...?
If you have a more active role, give some instructions...	Can you define me...? Can you tell me what... you mean?
	Can you link that idea with...? Imagine that... ? What could happen if...?
	Can you explain how you came to this conclusion? What alternatives could you consider?

Table 5. Example of questions for presentations.

Evaluation should consider the need to plan the summative evaluation of the products, with the presentation of the results of the project to an audience, the continuous feedback in groups, the completion

of daily tasks and formative assessment. Also facilitating students' reflection should be emphasized, sharing progress/results in pairs or small groups, followed by sharing with the class. In the following table some suggestions are presented.

Contents	Process
What did you learn from the project? What other skills were needed?	Did they collaborate effectively? What made us collaborate better?
What is the question to the starting question?	If it went wrong, what could be improved?
What other topics did the project make you think about? What other relevant issues would it be interesting to investigate?	What made the presentation effective? How could it be improved?
What is the best solution to the problem and why? What other solutions would make sense?	Do we use problem solving skills? Time management?
How were the contents of other subjects useful?	What other skills do we need to practice better?

Table 6. Example of questions to facilitate students' reflection.

Supporting group self-assessment and assessment, pointing out exactly what they did, when, how, what they like the most, what should have been explored, remembering that assessment will be integrated with that of colleagues, observations and the work presented, evaluating collaboration anonymously, with each person evaluating group members, giving each group 100 points to divide by each member according to their involvement in the task, are also other suggestions to involve students in their self-reflection and promote their self-regulatory improvement.

All this process should end in the celebration of the projects toward an audience. Particularly in this moment, some hints are essential:

- Invite the audience to stay after the presentations;
- Invite school or community members to recognize work;
- Explicitly communicate satisfaction for the tasks performed;
- Communicate with the community;
- Perform some ceremony;
- Create an archive with the best projects;…

6. Digital Tools to Support PBL Projects

The inclusion of ICT and Web 2.0 functionalities in the classroom has changed the way individuals learn and teach. Of the numerous possibilities of using technology-supported environments, we highlight the ability to allow different responses according to the needs and different types of competencies from students, enabling flexible motivational approaches and articulating interdisciplinary content. On the other hand, the different technological means used in educational contexts allows the adaptation to different forms, rhythms and practices in the classroom, promoting more individualized learning and valuing self-discovery. In this sense, several authors highlight the role of ICT as an important element in learning (e.g., Ponte, 2002), both in the appropriation of contents, in the development of competencies and in the creation of attractive spaces for interaction and exchange. Despite the investment in equipping schools and universities with computer equipment, the development of ICT training plans for teachers and the increasing use of computers in administrative and bureaucratic tasks seem to result in a considerable resistance to the use of ICT in the classroom (Paiva, 2007), as well as to accumulate difficulties in their effective use (Grosseck, 2009). Signs of these difficulties are registered in several research studies, demanding knowledge and skills updates.

Initially, the internet was presented as a repository of text pages, without much interactivity and with many contents closed to free access. In 2004 a new revolution was perceived in the IT industry when Tim O'Reilly and MediaLive International suggested the emergence of Web 2.0, innovating the possibilities of interaction and collaboration among users, but also in the promotion of open access content. The new tools allow users to produce knowledge without implying a deep knowledge of computer science (e.g., Coutinho & Alves, 2010; Parker & Chao, 2007). Many applications and tools have also appeared that allow users to publish and disseminate information easily and quickly (Coutinho & Alves, 2010): programs that allow the creation of social networks, collaborative tools (ex.: blogs, wikis, Google Docs), online (live) communication tools (ex.: SKYPE), video access tools (ex.: YouTube), among others.

With experience necessarily come reflections on the opportunities of integrating these technologies in the classroom, but also on the limitations and obstacles to their use (Hayes, 2007). Technologies are then seen in a different light, and their numerous benefits are reinforced

daily, such as in learning (e.g., Ferreira & Martins, 2009). Subsequent studies seem to accredit the benefits of these tools in learning and educational interaction. For example, there are studies that report the advantages of blogs as a space for access to selected and specialized information, provided by the teacher, allowing it to be commented on by students (Coutinho & Alves, 2010; Cruz, 2008). Wikis also appear as simple collaborative tools, useful for creating electronic portfolios, but can also be used as a text editor allowing greater orientation/availability of programmatic content (Parker & Chao, 2007). Although it is often considered as a means of entertainment rather than learning (Cruz, 2008), YouTube is also presented as a simple device for multimedia content useful for learning. In the multimedia domain also, the Podcast can be useful in the distance learning process, allowing the teacher to provide materials, documentaries, interviews, which can be listened to by students at any time and in any space (Coutinho & Alves, 2010).

However, in education, the ICT integration process has been slower than expected and with few schools having resounding success, which reinforces the need to better understand this reality and seek alternative plans for its implementation (Almerich et al., 2011). This may be due to the lack of confidence in the integration of technologies (Hatlevik, & Hatlevik, 2018), limited skills and low use of technological resources by teachers, especially at the level of functionalities, tools and more advanced actions that allow creating those resources and opportunities to create richer learning environments (Almerich et al., 2010). Studies have also shown that even in successful experiments, teachers need organized support to enable them to develop new approaches and tools for teaching, as well as access to reliable technology (Davis, Preston & Sahin, 2009). Also, peer support can have a positive effect (Hatlevik, & Hatlevik, 2018). Exploring different applications, and websites dedicated to the dissemination of effective programs for an educational context, can support teachers in their decision of using useful digital tools in higher education. One of these websites is: https://www.toptools4learning.com/

According to the website, in 2022, the top digital tools used by educators and students in colleges and universities were:

According to teachers' needs, there is a myriad of digital resources to support teaching and learning, whether they might be:

- Web tools and resources;
- Social and collaboration platforms;

+/-	TOP 300	TOOL	BRIEF DESCRIPTION	PPL	WPL	EDU
0	1	YouTube	video hosting and sharing platform	✓	✓	✓
+3	2	PowerPoint	presentation software	✓	✓	✓
0	3	Google Search	search engine	✓	✓	✓
0	4	Microsoft Teams	enterprise collaboration platform	✓	✓	
-3	5	Zoom	video meeting platform	✓	✓	✓
0	6	Google Docs & Drive	office suite/file sharing platform	✓	✓	✓
0	7	LinkedIn	professional social network	✓	✓	
+4	8	Word	document tool	✓	✓	✓
+4	9	Canva	graphics tool	✓		✓
-1	10	Wikipedia	online encyclopaedia	✓	✓	✓

Figure 2. Top digital tools used by educators and students in colleges and universities (from https://toptools4learning.com/).

- Office suites and tools;
- Content development and editing tools;
- Learning platforms and tools.

According to the specific need of the project, whether for learning promotion or as for evaluation, digital tools can play a particular role. In the following figure (Figure 3) we can find out the most popular tools for personal learning, workplace and education.

Integrating principles, but also resources, teachers can try to integrate all information in a first draft of the project. A proposal of model for synthesis of the information is presented bellow and can be adjusted according to teachers and higher institutions' needs. It is particularly important to introduce digital tools in different moments of the projects, not only to promote motivation and students' engagement, but also to facilitate teachers' feedback and management of the different projects.

Conclusion

In the last few decades, we have been assisting to an increasing attention to quality and improvement in higher education. This movement

Figure 3. Top 100 tools for learning 2022. (from https://toptools4learning.com/).

is particularly important in research agendas, but also in teaching practices and learning opportunities. However, the adoption of innovative methodologies is crucial to give support and framework for these practices. With the present chapter, we intended to present literature contributions and a proposal to support teachers' practices using PBL in higher education with the support of digital tools. After their first experience, teachers are invited to reflect about the results and the design process to improve their projects. Usually, several editions are necessary to achieve the best effect in students' learning. But with the collaboration of peers and colleagues, the sharing of experiences and the reflection about practices, opportunities might emerge to promote students' and teachers' motivation and satisfaction with higher education.

With the present chapter we aimed to present a brief review of the literature, exploring some of the most well-known references in PBL training and research, but much is still to be done. Exploring curricular pathways with PBL in different courses, integrating with other methodologies and technologies, is a hot topic in research and pedagogical practice. Also, best practices for interdisciplinary and civic engagement, particularly in an increasingly digital context, is an issue that deserves more attention in the future. Considering the developments in the last decades, more research and teachers training is necessary to promote excellence in higher education. We expect that the present chapter could contribute to this movement.

General View of the Project			
Name of the Project		Length	
Course		School year	
Obs.			
Overview			
Abstract of the project			
Driving question			
Entry event			
Aims and skills to be achieved			
XXI Century skills (How do you promote them?)			
	Collaboration	□	
	Communication	□	
	Critical Thinking	□	
	Creativity	□	
Resources	ICT Tools		
	Equipment		
	Materials		
	Other		

Page 1/2

General View of the Project					
Assessment	Formative	Test	□	Presentations	□
		Records	□	Notes	□
		Webquests	□	Checklists	□
		Draft versions	□	Conceptual maps	□
		Others: _____			
	Summative	Written works / Essays	□	Performance: _____	□
		Oral presentation	□	Peer-evaluation	□
		Multiple choice	□	Self-evaluation	□
		Others: _____			

Products (How do you will evaluate the project?)		
Presentation to a public audience: □ Classroom □ School □ Community □ Specialists □Internet □ Others:_____		
Final Reflexion	Records □	Focus group □
	Class discussion □	Surveys □
	Others: _____	

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Part III

PBL Practice-based Reflection

6

Contribution of Project Based Learning to the Medical and Psychological Education

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CHAPTER 6

Contribution of Project Based Learning to the Medical and Psychological Education

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1. Introduction

Medical and psychological education is a challenging process having deep-rooted history. Especially in the last few decades, technological advances have profoundly affected traditional medical education systems and continues to be a subject of changes. Moreover, changing student profiles and their educational expectations force the system for revolutions. Studies reveal that Generation Z composed majority of today's university students are entrepreneurial, self-educated, self-sufficient, multitasking, self-informed, and goal-oriented. While the expectations from the graduates are taken into consideration in the hiring process, the prominent features are described as "ability to work in a team", "problem solving skills", and "communication skills" (Landry et al., 2018). Considering these expectations in the employment market, as well as the characteristics and learning

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styles of today's students, project-based learning (PBL) stands out as a promising teaching style for the near future. PBL, in a very broad sense, aims to identify problems for finding solutions, develop students' own competencies, and improve the ability of working as a team member by ensuring active usage of technology. In this context, PBL perfectly fits with the personal characteristics of Generation Z students not only by improving efficiency of undergraduate learning but also gaining skills necessary after graduation.

PBL is relatively a new methodological approach in medical education and there are limited number of studies investigating the effectiveness of this method in terms of academic performance and/or skill improvement. The unique characteristics and traditional nature of medical education make PBL difficult to implement into the classical curriculum although there are some successfully carried out examples in the literature. In a current study comparing PBL with case-based learning and the "chalk and board" method (didactic lectures), PBL method received higher scores than other methods according to feedbacks of medical students (Shah et al. al., 2021). Another study conducted on the nursing students also supported these findings displaying that PBL teaching strategy improves the learning motivation, resource management, cooperation, problem-solving, and critical thinking skills of students (Wu, 2014). It can be speculated that instead of taking a passive role in the learning process, playing an active role, and even designing their own learning process via a project provide significant contribution to learning motivation of students. On the other hand, Keator et al. (2016) have pointed out the challenges of developing a PBL-directed course in undergraduate medical education and suggested that this education method requires constant administrative assessment, evaluation, and refinement prior to integration to medical curricula of Millennial students.

While traditional medical education is in an old-aged, teacher-centric manner with didactic lectures and tutorials, employment of PBL may switch it to the student-centric way (Shah et al., 2021). However, during this transition period, medical educators may not be prepared and feel confident about the assessment of student's skills in the clinics, since the medical education mainly focus on the clinical diagnosis and treatment of diseases (Murphy, 2007).

Concerning psychological education, there are many advantages of PBL over traditional curricula, such as "improved integration of basic and clinical skills, improved communication, team working skills and

self-directed learning skills, and a more enjoyable and motivational format" (Onyon, 2012, p. 23). The theories from both education and psychology behind PBL are Information Processing Theory (Norman & Schmidt, 1992); Constructivism (Kemp, 2011); Self-Determination Theory (Chiu et al., 2021); Self-Directed Learning (Leary et al., 2019) and Adult Learning Theory (Knowles, 1984); besides, Students Interaction (Albanese, 2000); Reasoning Methods (Colliver, 2000) and Mixed Practice *versus* Block Practice (Kapitonova et al., 2020) are also present in PBL.

To our knowledge, there is no systematic scoping review in the literature comparing PBL with traditional curricula. Therefore, the effectiveness of this method is still open for further discussion. The aim of this chapter is to share PBL experiences of different institutions in diverse areas of medical and psychological education. In addition, the application details of the projects, the challenges encountered during the implementation, and the feedback from the students are also discussed in this chapter.

2. Our PBL Experiences

PBL is a kind of instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. Actually, as educators, many of us aware of the concept that 'knowledge is a consequence of experience' and education in our modern world can only be sustained and advanced by gaining experience through the successful completion of projects. While PBL aims to solve the problem encountered by the student via a project, it also provides the student experience in collaboration, detecting and solving problem, revising in created solutions, and eliminating the problems during the execution.

3. On training

In the process of the RESTART4EDU project, it has been realized that PBL strategies have been used by all of the educators in both classes and daily life, without knowing the strategy behind it. After completing

the PBL training, it is now appreciated that PBL is not simply "doing a project", but really is a "learning by doing" experience.

Specific scope of PBL applications carried out by different institutions are summarized below.

Project	Class	Instutituon/ Number of Students	Driving Question	Examples of the projects
A	Medical Students	Faculty of Medicine, "Ovidius" University of Constanța 70 Students	Inform patients to better self-manage their disease	Prophylaxis and management of diabetes mellitus
B	Master's students in clinical and health psychology	Universidade Católica Portuguesa 40 Students	Can Can we really see how the brain works in different daily tasks?	Video UAU
C	Medical Students	Eskisehir Osmangazi University, Faculty of Medicine 26 Students	How to facilitate to integration of anatomical information into a clinical case?	Presentation via Zoom meeting Create a video and share their experiences with peers on social media (Instagram?)

Table 1. Details of our PBL experiences.

A) Project on self-managing of patients' diseases

One direction which is more and more debated and accepted in the medical field is the idea that the patient can play an active role in managing their diseases. Thus, we witness a switch from managing specific episodes of disease to a broader approach, which transforms the patient from a simple receiver of treatment into an active and responsible partner. The concept of patient's therapeutic education enables the patient, with chronic diseases, to manage their disease, with all the subsequent benefits (World Health Organization, 1998). This knowledge is to be acquired from medical personnel.

During the one semester class that medical students (second year medical school) had as an optional discipline, we decided to use PBL methods for their training. We considered that the topic of the lecture

was appropriate for using this teaching technique, and that, by enabling the students to search for medical information and finding methods of transmitting this information to patients, we could rise their interest in the field and better prepare them for the clinical part of their training.

During the first meetings the students were presented with the general principles of patient's therapeutic education and case studies, with examples from real life, were discussed. The general theme of the projects was to develop means and messages used for educating their patients with different chronic diseases. They worked in teams of 4 to 6 students, and a schedule with important dates (date to create teams, to create the deliverable, to evaluate other's projects and to evaluate the activity of their peers) was given to them. They had 10 weeks to complete the projects. All these were managed in Moodle, by using specific plugins that allowed the students to communicate among them, with the teachers, and to manage their team, their documents, time schedule etc. The consensus was to deliver a presentation that contained a description of the way they managed the task and with the materials and messages that could be used for patient's education. Each group presented their results, and the consensus was that, through programs ran by student groups some of these could be implemented in real-life. The materials they created ranged from simple presentations to posters and even audio-visual messages that targeted the population at risk.

B) Project on seeing how brain works in daily life

Although each of us carries a brain that is the center of our entire existence, whenever we talk about it, students have a perception of something far away. Whenever we show fixed photographs or images of the brain, they are able to recognize and identify the different parts of the brain, but they seem to have difficulty relating the schematics they see with the brain itself or its functioning. One of the most challenging aspects of teaching neuropsychology is precisely to allow students to appropriate of an idea of the brain as close as possible to reality. For those who teach neuropsychology, it is clear that this teaching has to resort to images and movement and not to something fixed, otherwise students will think of the brain as something "frozen" in time and space. Today, numerous consortia bring together images of the brain (structural and functional), collected in hospitals, clinics, clinical trials, and other contexts; these images are made available so that brain research can proceed as openly and quickly as possible. Although access to these

resources can sometimes have a monetary counterpart, other times it is free. Thus, we can find, from the comfort of our home, thousands of archival images about the brain and its functioning. These images vary in quality and interest, of course, but the challenge for students is precisely that: finding quality images of the brain while performing everyday activities. This challenge is not only aimed at the final product (the UAU video), but also at the process: until the student finds what he/she wants, he/she will necessarily watch countless videos that will allow him/her to become familiar with the brain. So, the driven question was "can we really see how the brain works in different daily tasks?" and the learning objectives were (1) to choose a daily task (example, listening to music); (2) to look for a video about brain research that shows brain functioning while performing the chosen task; (3) to learn the kind of research used (context, aim, techniques, etc); and (4) to present and explain the video in the classroom (3 min + 3 min). The resources and tools used included the classroom, computers or equivalent devices, internet and datashow. It was expected that students could see the brain functioning as something real; to understand brain functioning in specific tasks; and to know different techniques to study the brain. The procedures included the planning, the implementation and the assessment and evaluation. Concerning the planning, in the first day, teacher explains the task and motivates to search for the best video; between the second and the fourth day, students perform autonomous tasks; the last day is dedicated to the individual presentation in the classroom. Regarding the implementation, the first day is devoted to detailed explanation of learning objectives and expected outcomes; between the second and the fourth day, teacher is available to clarify doubts about the work; in the last day, the classroom is prepared with the necessary requirements. In what concerns to assessment and evaluation, it will be taken into account the suitability of the chosen theme to the video presented; the video quality (source, research, year, etc); and the ability to present the video and what is implicit in it (methodology used) and explicit (what is seen and which brain areas are activated during the task).

C) Project on integrating anatomical information into a clinical case

Anatomy is one of the cornerstones of medical education. Classical anatomy education based on the dissection of cadavers and practice on the models. Altered expectation of students forced to modernize classical anatomy education and alternative methods emerged with

the development of technology. One of the most challenging aspects of anatomy education is transforming the knowledge to a profession in the clinics. If students do not reflect their anatomical knowledge in the clinic, everything may hang in the air which then reduces their motivation for problem solving and enhances their frustrations. Therefore, the aim of this project was to develop a novel approach in implementing technological tools to anatomy training to increase competency of students. The project was completed totally in four weeks, two hours per week. All of the project participants were preclinic medical students. In the first week, the project was introduced, and a WhatsApp group was created where ideas could be easily discussed during determination of the driving question. The students agreed that the most important problem to be solved was "the use of anatomical knowledge in a clinical case". At the end of the project, a clinical case mise-en-scene video was created, and case reports were presented to students from different medical schools. The videos and images created during the project were shared with all medical students in Turkey through social media.

4. On applying

At the beginning, we thought that duration of the project is not long enough to cover everything and finish the project on time. However, we then realize that even if you give prolonged time to complete the project, students usually tend to finish it at the last minute. Therefore, it is important to emphasize the underlying idea and prepare them as reliable, self-sufficient, creative, and critical thinkers who can take on any challenge. After completion of PBL application, we were confident that this experience guides them to real life practice by encouraging their higher order thinking and problem-solving skills.

Besides, since new generation extensively uses the technological devices, including these tools to the PBL enhanced their contribution and overcame some issues such as lack of motivation and feeling of hopelessness.

5. Students' opinions

Overall, in all three different settings we received similar types of feedback from students in favor of PBL method. However, each scientific field has also required its unique characteristics.

In terms of medical education, majority of the students considered PBL as an interesting and inspiring experience, and they really liked to share experiences with their peers and display their productions. The students also gained today's indispensable skills, like collaboration and communication, for developing professional networks. Most students found the experience innovative, appealing and interesting. The possibility of implementing the project outcomes into real-life conditions has been a key-factor in student motivation. Most students found the experience innovative, appealing and interesting.

When it comes to psychological education, students reported that they feel more motivated than usual to carry out the tasks and behave like "authors" while using their knowledge. It also gave them a sense of responsibility regarding the quality of the content to be shared with the teacher and colleagues and regarding the way of communicating that same content. Besides, in addition to the foreseen learning (in this case, the functioning of the brain), the students accomplished many unforeseen ones, which proved to be very enriching.

Students surprise us and sometimes discover sources of enormous quality and creativity, and this type of work is always very enriching for the teacher. In the search process, sometimes students may feel the need to change the topic and there should be flexibility to do so.

6. Challenges

One of the most significant challenges was being part of a teamwork and dealing with group dynamics. Since organization skills of each student was different, their contribution to the project might not be similar. It should be noted that some of the students could be very dominant. In such cases, protection of recessive students may not be an easy job for educators. Educators should not just assess the final products, but also consider and evaluate the entire process of PBL. Class management, solving problems and conflicts among the students were important and necessary skills to be developed in educators.

Therefore, all of these issues must be considered during the PBL training of educators.

Another challenge was timing. Especially more complex projects took longer time than it is anticipated. Time-consuming nature of PBL method might be particularly challenging for some students since 'lack of time' is one of the main objections among the medical students.

When talking about the functioning of the brain, since it is not seen, students tend to think about something distant and even abstract. Neuropsychology professors therefore feel the need for students to see the brain working and become familiar with these images.

For students, giving a public speech is usually very challenging. That's why they felt much more comfortable with their cell phones while sharing their opinions, thoughts, comments through the social media and electronic environment. Nevertheless, generation diversity should be considered. Other challenges regarding the medical students might be differences of students in their premed experience and ability to interpret complex information. Finally, monitoring about progress and outcomes is another main challenge of PBL. Sometimes it is hard to ensure that the applied PBL method is achieving the desired results.

Conclusion

The pandemic triggered the necessity of learning new technologies, but not in a boring and straight forward manner. In this sense, utilization of PBL in medical and psychological education seems to be a promising teaching method for the future and one of the most effective ways of consolidation in the learning experience. However, there is still a long way to go for the integration of PBL into education system. Having a better PBL infrastructure for both students and instructors will accelerate this integration. Although students were enthusiastic and excited while working on the project, they have difficulties in abandoning the classic didactic method, and show various level of adaptation. To overcome this problem, it may be useful to give pretraining about PBL method even before undergraduate education. On the other hand, instructors who are experts in the "stalk and board" method may also have adaptation problems in applying PBL. Lack of experience can be overcome by sustained PBL trainings, courses, and seminars to enhance the educator expertise and to standardize their facilitator role. Additionally, medical and psychological school curricula can be arranged in a way that can

be adapted to PBL. After the student-instructor-system harmony is achieved, there will be more reliable opportunities to make assessments and improvements about PBL.

In the future, students can involve in different projects without temporal and spatial restriction by creating online PBL platforms. In this way, participants can take part in various projects at the same time and join the project teams that they want to involve. As a result, increase in the efficiency of the PBL will enhance the participant's intrinsic motivation and thus productivity.

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7

Practical Experiences and Reflections. PBL in Social Sciences

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CHAPTER 7

Practical Experiences and Reflections. PBL in Social Sciences

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1. Introduction

Students born and raised in a technology culture (Prensky, 2001) also need to use these technologies in educational environments. 21st century students are referred to in the literature as the new millennium learner (Pedró, 2011), as the internet generation (Oblinger & Oblinger, 2005), and as the digital native (Prensky, 2001). It is thought that the increase in the use of technology by students in the current century also affects their expectations and learning motivations in terms of learning methods. The classical teaching methods, which involve the transfer of knowledge from the teacher to the learner in pedagogical formation education, have to change. It seems difficult at a higher

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education level to teach students without motivation. The learning styles of the new generation of students, who are exposed to technology from birth, as well as their expectations from teachers and learning environments, are changing. They are inclined to search for and find information on their own in online environments, and to share this information with people they do not know. Making new needs analyses in educational practices is required (Bilgiç, Duman, & Seferolu, 2011).

One of the various learning models for acquiring 21st century skills is Project Based Learning (PBL) (Rochmawati, Wiyanto & Ridlo, 2019). PBL is an active, student-centered teaching method that enables students to set goals autonomously, carry out meaningful projects, and develop products within real-world applications (Kokotsaki, Menzies & Wiggins, 2016; Brundiers & Wiek, 2013; Birdman, Wiek, & Lang , 2021).

Project Based Learning (PBL) combines classroom teaching and collaborative learning in an engaging way that helps students perform practical activities and engage in critical thinking. This approach helps students apply their knowledge and skills to real-world situations and develop a deeper understanding of the subject matter. At the same time, it enables them to engage in reflection about their work and the world around them, which helps them develop their analytical and problem-solving skills (Molina-Torres, 2022.

PBL provides an opportunity to take a more interdisciplinary approach to learn. Instead of learning about a single topic in isolation, students are exposed to the different ways in which knowledge can be applied in a variety of contexts. This encourages students to understand how knowledge can be used to address a range of social issues. For instance, a special issue coordinated by Rus, Sandu, and Tasenţe (2020) includes case studies made by students from the master's programs in Management of Public Institutions and the European Administration of Public Institutions and Policies. These case studies consist of public policy proposals to solve some social problems that the local and central administrations in Romania are facing.

In addition, PBL helps students to develop important practical skills such as communication, collaboration, and critical thinking (Piotrowska et al., 2022)..This enables them to better understand and respond to the complexities of different social contexts. Also, it allows students to develop a sense of autonomy and ownership over their learning by engaging in student-driven activities (Schneider et al., 2022). This helps them understand how the knowledge they are gaining can be used to make a meaningful impact on their community.

Thus, PBL is a model that contributes positively to learners. Moreover, it also contributes positively to teachers. Learners become the center of the teaching-learning process, by having a voice in their learning process and the autonomy to actively plan and manage their learning process (Dias & Mergendoller, 2019). Thus, students show higher self-confidence, engagement, and intrinsic motivation (Dias & Mergendoller, 2019). In addition, with this teaching methodology, teachers are also seen as being more stimulating and "humane" (Dias & Mergendoller, 2019).

Hence, these positive contributions of PBL seem to be properly applied to social science courses. Indeed, the pilot projects led by the authors of the present chapter, described in detail in the following section, allow us to demonstrate the effectiveness of PBL in this field. Furthermore, it should be noted the authors of the current chapter are all specialized in social sciences.

Moreover, up to date, to the best of our knowledge, all the projects included in this chapter represent a first attempt to apply PBL in the social sciences field. Although social sciences enclose a wide range of subjects (e.g., anthropology, economics, psychology, public administration, sociology, social work, etc.), they share a common goal when preparing future students to enter the labour market. More precisely, as Memişoğlu (2011) noted, social sciences courses must generate efficient citizens with creative and critical thinking, allowing the individuals to enquire about the current social values and drive the change for better living conditions in society. Bearing in mind the shared common goal in Social Sciences, the PBL approach emerges as a very fruitful approach to learning in higher education (Guo et al., 2020).

PBL challenges the students by shifting their "traditional" role as information receptors to a situation where they have the opportunity to engage in real problem-solving, assign meaning in the learning process, and actively construct their knowledge in the professional context (Guo et al., 2020). Moreover, social issues require holistic thinking, and it is quite likely that, by using PBL, students will be challenged to cross disciplines, which otherwise will not be approached in a traditional learning context (Harmer & Stokes, 2014). For instance, a PBL directed to social issues such as ageing can be developed with a group of social work students. However, despite using the PBL approach for social work graduation, the students will necessarily need to get some knowledge from other subjects, such as psychology. More than ever, students need to be ready to work in collaborative settings, which urges the need to

develop the so-called 21st Century skills, namely: communication, problem-solving, independent learning, and collaboration (Dias & Mergendoller, 2019). That's why PBL offers important opportunities to develop students' 21st century skills.

In the following section, we will briefly present a set of PBL projects developed in the social sciences field.

2. Presentation of the Projects

In this section, PBL projects are presented in the field of social sciences in Portugal, Romania, and Turkey. It is seen in the table that current digital tools are used in PBL studies applied in classes varying between 8 and 60 students at the level of higher education (vocational school, undergraduate, graduate).

Globally, there is a positive evaluation of all the implemented social sciences projects for several reasons. First, all the stakeholders were satisfied with the final results. The professors' training abilities were improved because they used another teaching methodology – i.e., PBL. Along the process, the professors were also allowed to get even closer to the students since it was possible to be more aware of the students' perspectives and experiences and views of the world.

Students were more engaged and satisfied during the learning process. The students had the opportunity to contribute to solving real needs and feel empowered in a constructive working environment. Besides that, the students developed several soft skills, such as critical thinking, creativity, flexibility, adjustment, communication, self-leadership, time management, teamwork, autonomy, and open-mindedness. Their feedback shows that the steps they took in building the project and implementing it are considered both as important and engaging. In addition, the students were very interactive with each other contributing to building a more healthy and positive learning environment. Within this context, the students felt they were included in the decision-making process and they felt valued.

Collaborative online tools make PBL easy. Students shared their work in the learning management system and provided feedback to each other. The students tried to find solutions together to the problems they associated with real life. It is expected that students' communication skills will increase as their own ideas find value. These skills will be used as valuable capital when business life begins.

Presentation of the Projects		
Project-1 (Romania)	**Class**	1st year of public administration graduation
	Number of Students	60
	Driving Question	Can students elaborate and evaluate an integrated communication plan?
	Examples of the projects	Communication in organizations (Comunicare in organizații)
	Goals/Objectives	1-Analyzing the strengths and weaknesses of the communication strategy 2-Establishing the audience segments and identifying the needs and interests of the target audience 3-Establishing the optimal channels according to the specifics of the target audience 4-Writing key messages depending on the type of audience and the specifics of the communication channel 5-Elaboration of the Gantt chart for PR activities and establishment of the budget for each activity
	ICT Resources that we are used	• FanpageKarma • RStudio • Zelist Monitor • SPSS•• • OneDrive • Prezi
Project-2 (Portugal)	**Class**	1st year of work and organizational psychology master
	Number of Students	8
	Driving Question	How do make AGOVI employees more aware, informed and committed to the company's goals?
	Examples of the projects	Route Changing (Mudança de Rota)
	Goals/Objectives	• To propose a set of activities/strategies that make AGOVI employees more aware, informed and committed to the company's goals.
	ICT Resources that we are used	• PowerPoint, Zoom, Videos, Moodle • E-mail, AGOVI documents • WhatsApp, Computer • Internet, Some images • Printer, as well as paper

Presentation of the Projects		
Project-3 (Türkiye)	**Class**	2nd year of vocational problem-solving skills classroom- Associate degree students
	Number of Students	50
	Driving Question	How can we use digital tools to raise public awareness to prevent violence against healthcare workers?
	Examples of the projects	Communication in Healthcare (Sağlık Hizmetlerinde İletişim)
	Goals/Objectives	1- To raise awareness about violence against healthcare workers 2- Learning how to choose and use digital tools 3-Improve problem-solving skills 4-Learn team spirit 5-Learn as a team
	ICT Resources that we are used	• Learning Management Systems (Canvas) • PowerPoint • Word • Video maker software (Movavi) • Google
Project-4 (Türkiye)	**Class**	2nd year of Health Institutions Applications
	Number of Students	50
	Driving Question	How can we achieve communication satisfaction in organizational life?
	Examples of the projects	Communication Satisfaction (İletişim Doyumu)
	Goals/Objectives	1-Analyze the communication problems 2-Effective communication environment 3-Self-management
	ICT Resources that we are used	• Learning Management System (Canvas) • Google Scholar • Excel/ SPSS • PowerPoint Office Program
Project-5 (Portugal)	**Class**	2nd year of Social Service
	Number of Students	20
	Driving Question	How can we mitigate the communication gap between the elderly in nursing homes, their families and the institution's employees?
	Examples of the projects	Nursing Communication (Comunicação em Enfermagem)
	Goals/Objectives	1-To know how communication flows in nursing homes 2-To know communication models and to apply them to a practical context
	ICT Resources that we are used	• Internet databases

Beyond the multiple advantages and benefits of PBL, from didactic practice, we have identified a series of four challenges that students face during the elaboration and presentation of projects in the field of social sciences. We have also identified a series of methods by which students can overcome the difficulties they may face.

1. Establishing the scope of the project: Students often struggle to define the scope of the project and often end up trying to focus on too many topics, resulting in a lack of focus and direction. This can be overcome by setting clear objectives and expectations and ensuring that everyone involved has a clear understanding of the project's scope.
2. Embracing a multidisciplinary approach: Projects in social sciences often require understanding and input from several disciplines, and students may struggle to coordinate the collaboration among different stakeholders. This can be addressed by having a clear plan and timeline, with breakout groups for each discipline that can collaborate and report back to the main group.
3. Managing data and resources: Managing data and resources can be a challenge in the social sciences, as the data and resources may be spread across many organizations, countries, and cultures. This can be addressed by delegating tasks, setting clear goals and objectives, and having all stakeholders adequately represented in the management process.
4. Presenting results: Presenting complex and often controversial results to a wide range of stakeholders can be a challenge. Students should practice their presentations and use visual aids to help explain their results in an accessible way. It is also important to convey the main message in an unbiased way while still considering the different stakeholders' perspectives.

Conclusion

Social sciences are a set of academic disciplines that investigate man's relationship with everything he encounters and place the human and the society, organizations, and communities formed by people at the center of the investigation while examining events (Kuper, 1996).

Ensuring learning in a relationship in a PBL team environment ensures that this need of the individual is met. Thanks to PBL, the individual, who is a social being, meets the needs of real life in the learning and teaching environment.

Synteta (2003) stated that three main stages should not be ignored in the PBL experience: the pre-project stage (preparation), the project stage, and the post-project stage (result). From this point of view, the following can be considered in three stages for future PBL applications:

In preparation, peer counselling can be important in the PBL experience. Getting opinions from academicians who have had PBL experience in the field of social sciences before the implementation of the PBL draft can make the process more successful. In the project phase, teachers guiding students and coaching them at every stage can increase the success of PBL. In the post-project stage, the strengths, and weaknesses that students experience in the learning process can be discussed.

Although there are some topics that every student should learn, the traditional teaching model appears to be out of date in terms of the skills that the labor market requires in a worker. PBL seems to bring what is missing: teamwork, group dynamics, and task-oriented research. These are important skills that may help students, and future workers, adapt to a working world that increasingly demands proactiveness and requires workers to adapt and learn promptly.

Among his many achievements in 1982, Richard Buckminster Fuller introduced the concept of the "knowledge doubling curve." He stated that from the 1400s to 1900, human knowledge doubled approximately every century. With the launch of the "Internet of Things," it is stated that in 2020, information will advance exponentially every 12 hours (Varghese, 2020). According to this point of view, the information produced, especially after the 2000s, is more than all the information produced throughout human history (Hilbert & López, 2011). Considering the folding speed of information, it becomes almost impossible to transfer unlimited information only in face-to-face classes. The PBL technique provides the opportunity to determine the time period in which students can expand their learning boundaries and resources. It has the opportunity to access information resources around the world by using technology. Students should not be limited to certain resources.

It may cause the instructors to have difficulty doing PBL studies with students who cannot use technological software or programs well. Some courses can be added to the school curriculum that can help students learn the programs they can work within online common areas. It can prevent time loss in the learning process.

With the instant access of the students to the Internet via mobile devices, control of the content used by the teacher in the lesson can be

ensured. In PBL teaching practices, each of the students can become an education and training supervisor, like an inspector. It can enable the teacher to update himself with new resources in the lessons conducted with PBL with the student who is constantly active. It can be used to continue learning throughout one's life.

In another train of thought, project-based learning (PBL) is an instructional method that engages students with real-world issues and challenges, encouraging group collaboration and critical thinking. This method can be especially useful for the social sciences for two reasons.

First, PBL promotes student-centered learning, which allows students to take ownership of their own learning. This encourages students to develop creative problem-solving skills that are essential for a successful career in the social sciences. Additionally, PBL can foster an environment of creativity and innovation in the classroom and can also be used to help bridge the gap between theory and practice.

Second, PBL provides an effective way to optimize classroom learning by introducing issues that extend beyond the traditional topics discussed in the social sciences. This allows students to explore issues outside their comfort zone, such as poverty, inequality, deprivation, etc., and reflect on the implications of these issues on society.

The implementation of PBL in the social sciences has implications for further research. For example, the impact that PBL has had on student learning would benefit from evaluating student engagement and performance in assessing the effectiveness of the method. Moreover, further research into how PBL can be used to teach certain social sciences topics from a holistic, interdisciplinary perspective could lead to a more well-rounded and engaged population of social sciences majors.

While PBL offers many potential benefits for students, such as deeper learning, improved critical thinking skills, and enhanced collaboration and communication, there is still limited research on it. For social science educators to gain a better understanding of the impacts of PBL, further studies are needed to explore the experiences and perspectives of both teachers and students.

From an instructional point of view, research should focus on the challenges and rewards associated with implementing, managing, and designing PBL as well as its effectiveness compared to more traditional instruction. Moreover, research should analyze the factors that influence the outcomes of PBL, such as the level of preparation, type of project, and structure of activities. In addition, research should consider the

impact of PBL on students' motivation, engagement, and transferability of skills to other contexts.

Other research questions include the extent to which PBL affects student attitudes and mindsets, such as the appreciation for social issues and social responsibility. Additionally, there remain questions on how to assess PBL outcomes, such as the types and levels of impact and appropriate methods for measuring these impacts. Finally, research should assess how PBL can be used to support student learning holistically, with a focus on the learning of knowledge, skills, attitudes, and social responsibility.

Having more data on the effects of PBL in the social sciences will provide educators with much-needed guidance on how to utilize it in teaching and learning. It will also help inform policymakers and educational administrators on the benefits of this pedagogical approach and how it should be prioritized in K–12 curricula.

In conclusion, project-based learning provides numerous benefits to students studying social sciences and has many implications for further research. The implementation of PBL has the potential to help students realize that the social sciences can provide a valuable lens for understanding many real-world issues while also developing useful skills for the future.

Recommendations

After the implementation of PBL with the students in the taught courses, but also after the improvement courses that the authors attended within the Restart4Edu project (both within the universities of Romania, Portugal, and Turkey, but also within the Summer School that took place at Eskisehir Osmangazi University), we would like to make some specific recommendations for future applicants of this teaching-learning method:

1. Prepare thoroughly: Before starting a PBL, be sure to review relevant literature and resources to gain a good understanding of the concepts and to anticipate possible solutions. Be sure to have an action plan in place and to have all the materials and technology required to complete the project.
2. Develop an effective timeline: Developing an effective timeline is key to successful PBL implementation. Prioritize tasks, set achievable goals and deadlines, and assign roles and responsibilities to everyone involved.

3. Utilize helpful tools: Utilize helpful tools, such as project management software or a project timeline template, to ensure that tasks are completed most effectively.
4. Ensure meaningful assessment: Ensure that any assessment that is conducted is meaningful and connected to the goals of the project. Consider how the assessment can help students learn and how it can be used to adjust the project throughout the learning course.
5. Foster collaboration: foster collaboration among all involved in the project, as this is the key to successful PBL implementation. Encourage students to work together, support each other, and use feedback from each other throughout the process.
6. Celebrate successes: Celebrate successes throughout the PBL when tasks are completed, milestones are met, and overall goals are achieved. This will help motivate students to continue their hard work and enthusiasm for the project.

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8

PBL Applications in Teaching Topics related with "Data"

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CHAPTER 8

PBL Applications in Teaching Topics related with "Data"

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1. Introduction

Data is defined as the measurements or statistics used as a basis for reasoning, discussion, or calculation (Merriam-Webster). Data is basically unorganized and unrefined facts and can be presented in a meaningful context when it is processed, organized, or classified. The importance of data collection, analysis, and visualization is getting more crucial especially on the Internet of Things (IoT) era.

Data science is an interdisciplinary field that uses scientific methods, processes, algorithms, and systems to extract knowledge and insights from noisy, structured, and unstructured data. The knowledge from data is utilized in various domains, including the daily life, but also in health, social, and basic science applications. Moreover, Data science has been an essential part of many industries today.

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In many disciplines, courses related to data science are being taught to undergraduate and graduate students. Saltz and Heckmann (2015) demonstrate that a project-based data science course is appropriate for physics, engineering, and other fields. Although there are several publications on data science, the effectiveness of how to teach the course face-to-face is not reported.

The authors of this chapter are the academicians working at universities in Turkey, Romania, and Portugal who have participated on the Restart4Edu project. After joining the online courses to gain insight about the theory behind Project-Based Learning (PBL), they have met at the workshop to discuss their teaching experiences in practice. Due to the importance of the topic "data", this chapter aims to summarize how PBL can be adopted to the courses taught at informatics and engineering departments.

Blumenfeld et al. (1991) state that "PBL is a comprehensive perspective focused on teaching by engaging students in investigation. Within this framework, students pursue solutions to nontrivial problems by asking and refining questions, debating ideas, making predictions, designing plans and/or experiments, collecting and analyzing data, drawing conclusions, communicating their ideas and findings to others, asking new questions, and creating artifacts". PBL contexts motivates students and enhances disciplinary learning (Gonzales and Batanero, 2016). Condliffe et al. (2017) states that the methodology is extensively used in engineering with good results. The design of PBL promotes students to flexibility and connections to working community (Potvin et al., 2022).

Gomez-del Rio and Rodriguez (2022) apply PBL in mechanical design subject of Mechanical and Chemical Engineering lab. The success of the methodology is assessed based on the non-formal quantitative survey with the students. It is concluded that the lab activities should be improved as less time consuming.

Saad and Zainudin (2022) review PBL and Computational Thinking (CT) related papers published between 2017 and 2021 and identified three frameworks, two models, seven tools, and six techniques from the current state of the art. Chiu (2020) highlight various benefits offered by PBL, including higher-order thinking skills, students' self-efficacy, cognitive strategy usage, self-organization, positive attitudes towards task values and group work.

Borodzhieva (2022) presents the results of the application of the PBL approach in the "Databases" course when teaching and studying

the topic "Relational Algebra". It concluded that PBL helps develop and practice some of the 21st-century skills such as literacy and numeracy, scientific literacy, Information and Communications Technology (ICT) literacy critical thinking, problem-solving, creativity, initiative, collaboration, and communication skills.

Based on the current literature review, the authors agreed that there are limited number of PBL applications in courses to teach topic related to "data". But it is promising that PBL have potential to involve the students to the course and help instructors to better convey the basics of the topic. By utilizing the forms shared at the Restart4Edu courses, the authors were able to structure their experiences in teaching.

2. Presentation of the Projects

This section aims to provide basic information on how PBL is or can be used in courses for engineering and informatics when teaching the concepts of real-life data, databases, and data from industry. Table 1 summarizes the information on the feature of the students, the number of students, driving question of the PBL application, and project steps and outcomes.

Table 1. Examples of PBL applications in engineering and informatics courses.

Project title	Class	# of students	Driving Question	Examples of the projects
PBL real-life data	Undergraduate 2nd grade	45	How can we assess and minimize the perceived daily noise exposure of people to sustain hearing health?	Revising the main concepts on noise, gathering data, using equations to calculate noise exposure, forming a creative poster
PBL database	Undergraduate 2nd grade	30	How important is to organize data using a database model	Efficient, consistent, reliable and optimized applications using databases for industrial data

Project title	Class	# of students	Driving Question	Examples of the projects
PBL data from industry	Associate degree 2nd grade	16	Optimal operation of the technological installation	Four installations from the refinery were chosen, namely atmospheric distillation, catalytic cracking, catalytic reforming, blending finished products
PBL data from industry	Undergraduate 2nd grade	16	The future of the oil and gas industry	Analysis of the implications of reducing greenhouse gases on oil plants (reduction of oil losses, environmental impact, impact on employees the emergence of green cars, use of new technologies in technological processes (green H_2, CO_2 storage, etc.)

3. Presentation of the project PBL in dealing real-life data

The PBL application is completed with undergraduate students enrolled to Ergonomics class in Industrial Engineering, Faculty of Engineering and Architecture, Eskisehir Osmangazi University. This application aims to attract attention the importance of noise, one of the environmental factors, in working environments and daily life. The students are expected to learn main principles of noise (pressure, loudness, etc.), importance of obtaining and organizing data, and they will be able to experience and experience different noise levels in various real-life environments. The PBL is structured for 5-week period. The students are informed about the aim of PBL and the schedule is provided. The students are requested to review the course noted shared from Distance Learning Platform (DLP) and make a visit to Science Experiment Center. A Quiz is conducted in the second week to assess if the main principles are understood. Students discuss possible locations to measure noise levels. Each student submitted their suggestions to obtain data (cinema, shopping mall, bazaar, apartment elevator, classroom, canteen, urban transportation (i.e., tram, bus) from daily life) by use of DLP. In the data collection and reporting, students downloaded a free app to their cell phones and recorded data for the noise levels of specific locations. A database for measurements were shared with students by the course

instructor. The written product of PBL application was defined as forming a poster. The posters, summarizing the activities and achievements during the project, was uploaded to DLP as a file by each student. The feedback from students concerning the project and activity design was received by a Questionnaire with five questions.

45 students completed all the four modules (Quiz-review of topic, Data collection location suggestion, Data collection, Poster, and Questionnaire-feedback) of PBL application in Ergonomics course. 44% of the students stated that they have a basic information of PBL and find it suitable for the Ergonomics course. The 46% indicated that they have never heard about PBL but find it suitable for the course. 3% have heard about PBL but does not find it suitable to adopt to the course. Likewise, 5% have not heard about PBL and does not find it suitable for the course. Rest of the students (3%) have stated no idea. It was promising that 89% of the students have reviewed the file shared by the instructor and 46% have visited the Science Experiment Center. The average of the review Quiz is 71 and it can be considered that students have a basic knowledge of the topic in concern. The students were asked to suggest locations for data gathering and then measure noise levels. The average grade for the activities is 76 and 77 respectively. Based on the noise level database, the students formed a scenario, calculated a noise exposure level, designed a poster, and submitted by DLP. A Questionnaire is conducted to obtain students' feedback and suggestions. 60% of the students stated that PBL was very useful, 38% useful. On the other hand, 9% declared that PBL application did not significantly contribute to learning. The students were asked to evaluate the PBL activities. 51% specified that they had difficulties when creating the poster.

4. Presentation of the project PBL in Databases

The PBL is used in database courses at Ovidius University of Constanta, Faculty of Mathematics and Informatics, undergraduate students. The goal is to focus on development of a database by a student or a team of students. In the context of today's applications and exponential technological progress, representing data and the tools offered by platforms or applications are the two main concerns. Since, data structure is getting more complex, organizational models, that must be known by students, are developed to increase the quality and efficiency of the applications. Relational databases represent such

a fundamental model. By using PBL, students can better understand the importance of data organization, the advantages of using models and thus become better adapted to technological changes. The aim of the project is to focus on developing a database. The project is used according to the traditional method of learning and uses progressive questions and answers organized in laboratories. Students are organized into small groups (maximum 3) and apply the relational database model, creating their own model for a real-world application. It takes some knowledge, but also intuition for a better solution. Knowledge consists of database concepts, analysis, design, implementation, and project management concepts. Each team prepares presentations with the answers that are reviewed and discussed in class. Corrections are made by the teacher and other students. Real-world database applications with low complexity are developed for a better understanding and motivation of students. The existence of several solutions to the same problem and discussions about choosing the best one is constructive. The method helps students to check the advantages and disadvantages of their solutions. Learning objectives of the project are understanding the importance of data organization, understanding the architectural vision of a system, using existing models of data organization as relational databases, and easily adapting to changing context. The required time is planned at 5 weeks. Evaluation methods are used for results. The results of using PBL were better than traditional ones, showing a better understanding and motivating students.

5. Presentation of the project PBL for big data in industry

The PBL is used in courses at Ovidius University of Constanta, Faculty of Engineering, Department of Chemistry and Chemical Engineering undergraduate students. The oil, gas and gas extraction, and processing industries, benefit from increasingly centralized technological processes, based on a wealth of data collected, analyzed, stored, and used in the control of industrial technologies. Different levels of automation take place after the analysis of large amounts of data (process temperature and constituents, concentration of final products and fluids in reactors, their volume and density, etc.). In preparing students to understand the process of data collection and automatic control of chemical plants usually, teachers focus on presenting the processes of automation of chemical plants (due to insufficient hours) and less on

the analysis of data in a chemical plant (part of technological process of extraction, transport and processing of crude oil and natural gas).

The project consists of technological and constructive analysis of a chemical or industrial process (chosen by the group of students from those proposed by the teacher), studying how it works, identification of databases that may arise, data processing, realization of numerical models necessary for the optimal functioning of the industrial process. Each group includes four students who are chosen with the following steps. In the first stage, the groups are formed according to the degree of affection of the students. After completing the groups, the students received a test to assess their personality and integration into the group, depending on the result, the groups have been recalibrated to ensure their functioning, the roles of the students in the analysis group (project director or manager, system secretary or integrator, product manager or sales manager and critic or staff using this product) were also named. Each group of students received a project evaluation grid and an evaluation grid of students' roles in the project. The students also received a project framework for the research topic consisting of:

a. the analysis of the specialized literature in the description of the chosen technological process,

b. estimating the differences between the projects described in the literature and the researched industrial project,

c. determining the level of data required to be collected and the technology for processing them,

d. establishing the level of data retrieval and processing and numerical modeling of the technological process,

e. submission of the project for analysis to the tutor in the analyzed chemical installation,

f. presenting this project to colleagues and teachers,

g. correcting the project according to the suggestions of teachers and colleagues,

h. dissemination of results through the publication of articles and the presentation of scientific papers at some student scientific conferences.

The expected results of the PBL can be summarized as, understanding industrial processes, obtaining numerical models to simulate the technological process, analysis of data collected from the project

and their processing, understanding the deletion of data that does not impact the process, and ensuring good collaboration between students.

Conclusion

The online courses and the workshop that enabled face-face discussions organized within the context of Restart4Edu project was very fruitful for each participant from different countries. The well-planned activities encouraged the instructors to get to know each other in a short time, introduce their courses, and exchange their experiences in a friendly atmosphere. All participants were aware of the benefits of PBL applications. Although, most of the successful examples were from education and literacy departments, the authors of this chapter from engineering and informatics wanted to attract attention on how PBL can be used in teaching the topic "data"

Based on the literature review, up-to-best knowledge, PBL was applied for the first time in an undergraduate Ergonomics course to teach concepts related to environmental factors. Based on the feedback Questionnaire, 68% of the students agree that the topic "noise" is appropriate in Ergonomics course. However, other topics such as musculoskeletal disorders, manual materials handling, and illumination taught in the course can also be structured by use of PBL principles. The PBL activities (location suggestion, data collection, poster) was completed by students individually. The students suggested that application could be carried out in groups (e.g. minimum 2 maximum 10) and the posters could be presented to other students for discussion. There were no complaints on the time schedule of the PBL activities. The students enjoyed getting involved in the learning process. For a successful PBL application, the course design involving the constraints and the criteria is very important. Structuring the activities and forming the time schedule may be time consuming for the instructor. The students are informed on objectives and outcomes that are expected to master and measurable assessment criteria are defined as to help students to know their progress on the tasks. However, peer assessment was not used throughout this PBL application.

Using PBL assessment results were better for a group of students if they are motivated and well guided in Database courses. An improvement of student attitude toward the course and better exam grades were notable. Similarly, to the results of (Borodzhieva, 2022), students were

satisfied with the approach used, confirmed that they had learned more about the topic, and demonstrated increased success. Also, it might be seen that project-based learning can improve students' learning outcomes in science learning and train students in problem-solving (critical thinking).

The use of PBL in understanding chemical processes and processing industrial data is the best teaching method, as it ensures the introduction of the student in the roles of productive employees and in the handling and processing of the properties of the analyzed technological processes. In the future, the analysis of databases by PBL methods can be applied in the pharmaceutical industry and to ensure the health and comfort of citizens, all these processes being providers of data necessary to be analyzed, processed, and stored.

There are few studies that provide detailed descriptions of PBL projects. All teams can carry out projects based on the same tasks as introduced in Halverscheid (2005) and Monaghan (2007). Alternatively, as stated in Polman and Pea (2001), each team can choose a unique topic for their project during the study of project-based classes. The analysis of student projects can be varied for different teams if the topic is not uniform. This multidimensional diversity becomes an additional challenge for the teachers planning and implementing PBL (Palatnik, 2022).

Course design is very important when transferring the knowledge to the students. When teaching, the blackboard, chalk, and talk style is now considered outdated. Considering the variety of the sources of information and the high expectations of the new generation, new teaching styles are crucial in higher education. Based on the studies in the literature and experiences, PBL applications can inspire students to learn the basics of the topic in concern and to improve their skills on how and where to access the right information. To achieve successful results by adopting PBL, instructors should follow a framework to structure course content, decide the duration of the application, define the assessment criteria, and the number students and/or groups. Since there is no single magic strategy for teaching, the international projects like Restart4Edu can help instructors from different backgrounds to exchange their experiences.

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9

Higher Education Students as PBL Receivers in Interdisciplinary Teaching Experiences

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CHAPTER 9

Higher Education Students as PBL Receivers in Interdisciplinary Teaching Experiences

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1. Introduction

This chapter aims at gathering the experience collected from the practice of four different Project-Based Learning (PBL) teaching outcomes organised both within the area of social sciences and of exact sciences. Each project comes from a different area of knowledge (Corporate Communication, Physics, Law, and English for Academic Purposes [EAP] in International Relations [IR]) and therefore presents an interdisciplinary approach to the PBL methodology. Authors were driven by a common purpose and presented their projects at the Summer School of RESTART4EDU Erasmus+ Strategic Partnership

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project in Eskisehir, Türkiye in June 2022. During the event, the authors from three different countries got together and decided on the scope and the purpose of this chapter collaboratively in one day round table discussions. Given the fact that each project comes from a different area of knowledge, the chapter focuses on undergraduate students as the main subject who benefit from the experience of learning by project. Specific assessment issues motivated the design of each project: the five teachers involved had the intention of developing complex skills in their students, thereby training them, and fostering their ability to acknowledge different forms of assessment as well as different formats of presenting their work and to assess both their own work and the work of their colleagues in other groups. Students were therefore confronted with the possibility of deciding about the structure of their presentations, the materials in use, the forms of evaluation that were chosen and eventually their own advantages when entering a PBL project.

The application of the Project-Based Learning (PBL) approach, from the point of view of training the future specialist in the field of social sciences, will allow learning by discovering new knowledge in the conditions of activating one's own thought process. It is an approach that places students at the core of any teaching-learning process through solving simulated or real problems and encourages constant reflection on the learning process (Hmelo-Silver & Barrows, 2006). Hence the interdisciplinary approach in terms of planning and structuring the projects seems to be a very productive endeavor. In addition, PBL strongly favors enhancement of transversal skills, or soft skills as noted in OECD (2009), such as problem-solving, collaboration, independent learning, and communication (Bell, 2010). Therefore, adopting and implementing the PBL approach, which embodies a subject-free characteristic, in training specialists in higher education has appeared to be an effective means of allowing learners to have more active roles in organizing their learning. As also concluded by Dias and Mergendoller (2019), this approach clearly has the potential to motivate learners to take the ownership of their learning and helps them advance their transversal skills of collaboration, communication, critical thinking, and creativity. Moreover, in active learning experience students look for solutions to a vast array of problems and use procedures of their own choice (Lewrick, Link, & Leifer, 2020).

2. Methodology

When applying PBL strategies, methods largely depend on the nature of the subjects to develop as well as on the type of students in the class and their maturity level. This applies to all teaching levels and to most subjects, considering the diversity of instructional plans as well as the differences in cognitive development. Teachers are often confronted with students that are not used to develop their academic skills. They are used to listen and to reproduce whatever contents they listen to, which reflects a transmission-oriented approach. The assessment they expect is also based on the reality they know about, meaning they expect to be assessed about their capacity to reproduce enacted speech.

This section is organized under a matrix of four different projects and four different themes and areas of research. PBL methodology has been used by each project considering the possibilities of improving students' results as well as their capacities for receiving information and instructions in every area. We propose a SWOT analysis regarding each project and each case. We will present the different original approaches in terms of the 4 parts of the analysis, under the perspective of students as subjects of the PBL methodology. All projects were grounded upon original teaching practice and revealed original learning outcomes.

3. Strengths / Opportunities

3.1 Corporate communication

Students were able to develop thematic resources based on the general bibliography connected to the syllabus in use (Shockley-Zalabak, 2015). These resources provided information about the chosen theme, and this resulted in three different approaches addressed by each group. The venue was organized as well as the report about the event, thereby allowing students to generate autonomy in their presentation. Each group had the opportunity to assume thematic choices within the general theme (Harris & Nelson, 2019), and decide about the best invitations from external entities to participate at the venue. Eventually the self-assessment report was built according to the plan and to the observation of the results; results were also assessed by the rest of the class. assessment capacities were challenged as well as the capacity to follow the general guidelines for project demands.

3.2 Physics

Students learned about the laws of thermodynamics through experimenting and directly connecting two physical situations in which problems had to be solved (Holubova, 2008). The higher advantage was the possibility to embody physical experimentation and the opportunity to compare heating situations and to learn about the conditions that can change the situations and improve them. The basis of autonomy was very strong and so decisions and attitudes had to be made by the group (Wiggins & McTighe, 2011).

3.3 Law

The cases presented were related to the European Court of human rights and address situations of clear violations of human rights. students learned how to solve these cases, considering the law approaches, their possibilities of judgement and understanding of violation situations (Mindea, 2011). They were asked to compare similar cases of human right violations and to make decisions about the results presented by the court. The project has a clear contribution in stimulating creativity and designing arguments as well as in increasing the student's self-confidence and their capacity of time management. They were also challenged to control emotions until they developed strong teamwork skills.

3.4 EAP in International Relations

The strengths and opportunities of using PBL in EAP IR context can be approached in two categories. One is emerging subject-specific strengths and opportunities, and the other category is related to general skills or competencies. As for the strengths in EAP IR context, students faced the possibility of understanding and of using the discourse of international relations scholars. They learned how to develop a sustainable online library for undergraduate courses, and they got connected with renowned scholars of the area. The main goal in the PBL practice was preparing and organizing live/recorded presentations using digital platforms and creating tools to disseminate their presentations. Although the course officially aimed to focus on improving advanced English skills of IR students, the aims and the content were transformed into an interdisciplinary characteristic through the PBL approach.

In addition to these subject-specific strengths, the PBL practice in EAP context also revealed several strengths in enhancing students' transversal skills. First, the practice fostered students' teamwork skills. Secondly, the PBL practice enhanced students' use of digital/online tools in project work. They all engaged in a variety of digital tools throughout the PBL practice. All the stages fostered learners' autonomy in their learning process, engaging them in a lot of individual and team decisions throughout the PBL practice.

The main opportunity in applying the PBL seemed to apply an innovative learning approach i.e., PBL move in the department as it showed different strategies, practices and tasks to both the students and the other lecturers. This program has a characteristic of being highly technology-integrated and students are to create a number of projects throughout the program despite the PBL approach is not explicitly adopted.

4. Weaknesses / Threats

4.1 Corporate communication

The general organization of the groups' needs reformatting for several reasons: first each group needs to understand the format of the product presentation and only then will they be able to schedule a venue. Also, groups need to understand the difficulties in proposing invited speakers according to the theme and to the available bibliography. Time management was also an issue, and the overall conclusion was reflected as a difficulty in self-assessment.

4.2 Physics

There is a difficulty in having students discussing the topic of physics with interest. This created difficulties in understanding the concepts and in addressing the problems in a personal way. The maturity of the students is one of the reasons for some of the difficulties that were felt in the project because students were frequently submitted to a transmission-oriented approach. Another difficulty was caused by problems in expression and in oral presentation and in some cases, there was a difficulty related to the mastering of digital technology. In some cases, students have difficulties in relating to work in small teams of 15 students.

This led to some problems in the assessment as well as in the understanding of the purpose of the whole project.

4.3 Law

The whole project of sharing and solving cases related to the European Court of human rights requires a lot of time for organization development and evaluation. During the process students may feel a decrease in motivation which stands as a clear threat to the development of the project. Time management was a problem because organizing a PBL project requires a lot of details and needs accurate planning.

4.4 EAP in International Relations

PBL practice in EAP context includes several weaknesses. A number of students did not take part in the PBL task and thus failed the course. Another weakness could be highlighted as several students tried to embed themselves into the teams which had more active students and thus increase their grades without showing a high performance. Lastly, all teams preferred preparing a record of their presentation – instead of live presentations in the classroom – this was a weakness in the PBL practice as detrimental to the variety of presentation types.

One of the main threats in applying PBL practice in EAP context could be listed as students' low level of familiarity with the PBL approach, which could have been a risk for their adaptation to the new approach. Another threat was the total number of students in two separate cohorts. A third threat to the PBL practice came from the lack of language proficiency in students' background in the PBL practice.

5. Findings

The next table attempts to describe the general conditions for application of a PBL plan. This chapter includes four projects developed in different areas and therefore this table will include some data related to each project. We assume some descriptive items like project name, class, and number of students, as well as more comprehensive items such as the driving questions and some examples of products (Table 1.).

Table 1. Descriptions of PBL practices in four different study field in three different countries (continues in the next page).

Project Name	Class	N. of Ss	Skills and competences	Examples	Impact
Perspectives on corporate communication (Portugal)	Undergraduate 3rd year Communication Sciences	35	• Developing thematic resources for a public venue • Discussing themes from syllabus with invited speakers • Assessing group performances	• Conference • Broadcasting materials • Communication documents: poster, flyers, presentations • Report for assessment • Video recording and photo register • Q&A	• Fostering autonomy and organizational skills • Developing public relations skills • Contacting with external publics • Developing speaking skills in public contexts • Enhancing teamwork skills
Sustainable heat management solutions for comfortable homes (Romania)	Undergraduate 1st year Technological Physics (TP)	15	• Learning about Physics scientific themes in real life situations • Exploring theoretical concepts in Thermodynamics • Explaining and applying the concepts as discussed • Project design	• Experimenting floor heating structures • Controlling heat transfer • Using Ground Source Heat Pump (GSHP)	• Developing ability to activate the knowledge already acquired, evaluate the learning needs, make a learning plan • Developing critical thinking • Acquiring ability to listen to and respect the opinions of others, to carry a dialogue and answer questions, to express personal opinions, to speak and write to diverse audience

Project Name	Class	N. of Ss	Skills and competences	Examples	Impact
Making Human Rights Visible (Romania)	Undergraduate 4th year International Protection of Human Rights	30	• Promoting respect for Human Rights at national level • Understanding the impact of defending Human Rights • Acquiring skills for emotions control • Developing teamwork and time control skills	• Investigating cases of violation of Human Rights • Finding instructions to address cases • Explaining the cases and the chosen situations • Proposing solutions for problems / cases of violation of human Rights	• Autonomous thinking • Developing research, argumentative and analytical, skills • Having a practical context to the acquisition of theory ("playing to be a lawyer") • Active involvement in the learning process • Having the opportunity to give their own opinions based on the readings, to give different opinions and been guided through the discussion • Learning how to learn by their own • Listening to others' opinions • Learning how to write a legal opinion
Adopting PBL approach in EAP context to engage freshman IR students into IR society (Türkiye)	Undergraduate 1st year International Relations Advanced English course	44 students (morning class) + 40 students (evening class)	Collaboration/ Teamwork Learner autonomy Integrating digital tools into projects Presentation skills Inquiry skills Reflective skills	• Reviewing/ understanding the IR discourse • Developing a sustainable online IR library • Connecting to renowned IR scholars • Creating sample interview /talks as IR scholars • Preparing and making live /recorded presentations using digital platforms/tools • Disseminate digital presentations	• Fostering autonomy and organizational skills • Developing speaking skills in public contexts • Developing creativity • Enhancing teamwork skills • Developing competence in using digital tools

Conclusion

The advantages of using PBL clearly outnumber the disadvantages in a meaningful array of positive consequences. The projects described in this chapter resulted in a higher awareness of each working group's scientific knowledge and, in some cases, in a positive investment regarding individual skills and group structure. Even if there were cases of less positive engagement along the proposals, students understood and complied with the necessary effort and creativity – and this is a common assessment along the four projects.

The possibility of assessment through active learning instructional plans, as well as their thorough and detailed execution has led to fostering teamwork among students. The planning also resulted in enhancing students' use of digital tools in project work, with the expected gains in mastering ICT tools. The well-directed use of social media for broadcasting results was efficient and the general use of Google drives facilitated contact during meetings and during follow-up assessments.

Each scientific field was approached in an autonomous mode. Therefore, students were challenged to develop communication skills, both in presenting and in contacting persons of interest. This was a common endeavor to every project: students developed both proactive attitudes and theoretical dialogues and debates, thereby strengthening their personal convictions and their essays. Guided research has built confidence, motivation and connection between students, teachers, and audiences.

At the end of the project students were able to: recognize in real world problems the usefulness and applicability of field-specific notions; apply the basic concepts of each subject to solve relevant problems, to use and develop digital tools; retrieve and process technical, juridic and communicative information and apply relevant methodologies to the field-specific problem; work in teams and manage self and relationships in order to carry out a complex, practical project; look for acceptable compromises to solve them, complete tasks in time, avoid and manage conflicts, support teammates to complete the project on time.

In conclusion, our PBL experiences in four different study fields (i. e. Corporate Communication, Physics, Law, and EAP in International Relations) in three different countries (i.e. Portugal, Romania and Türkiye) have revealed two sets of implications for PBL practices in the future. Our first set of implications include the ones specific to each study field and syllabus. The second set addresses students' skills and

particular capacities, and the extent to which they would benefit from PBL methodology.

Study field-specific implications:

- Corporate Communication subject will continue to develop the PBL methodology in the current year. Digital materials will continue to be developed according to general knowledge of the area, both to promote digital skills and to introduce specific contact with influencers and media providers.
- Future PBL practices in Corporate Communication will consider the participation of students as speakers and will therefore apply to the development of presentation skills related to the theme of each conference.
- PBL practices in Physics will aim to involve students in the creation of materials that connect theory and practice, in the sense of approaches to PBL standards. These materials can consist of presentations in the scientific sessions organized at the faculty level and, depending on the results, be concretized in articles that can be sent for publication in specialized journals.
- At the same time, PBL practices in Physics can acquire a multidisciplinary aspect, by co-opting other students from other specializations in projects of common interest.
- A particular strength of PBL applied to law students is its ability to integrate and encourage the actual application of learning. Self-directed learning combined with PBL sessions helps students to build up their own repertoire of competence, that is important that students in law gain familiarity with a broad range of research resources including primary sources such as statutes and cases; and other secondary sources such as text books, practitioner texts, journal articles and official publications such as the guidelines from York Law School: Guide to Problem Based Learning.
- Enhance students' skills to acquire principal and key concepts that should be better retained by the learners and allow them to use information learnt in other similar situations.
- PBL practices in future EAP contexts will include the integration of original and digital materials such as newspaper articles, blog entries, interviews with renowned scholars into tasks so students are introduced with the discourse of their study field, which will increase their engagement to the course and sense-of-belonging to their study field.

General implications related to students' skills and capacities in PBL practices:

- Integration of digital tools into PBL projects is essential in higher education in our digital world so the PBL practitioners should seek ways to enhance their competence in using digital tools and encourage learners to develop digital literacy in their study field.
- Presentation skills must be developed and stimulated according to the specificities of each project. PBL practitioners can ask for learners' individual or group presentations and follow-up reports. These tasks need detailed planning, organization and evaluation procedures. The learners must be presented with clear instructions, scheduling and guidelines in advance. Digital tools are fundamental and motivating along the process.
- Teamwork should be stimulated and the general aim of the project will enhance active learning within various disciplinary contexts. Assigning some tasks to be done in teams in PBL practices will advance learners' collaborative skills. In these tasks, the roles between teachers and learners differ but eventually converge in the outcome.
- Applying PBL practices in crowded higher education classes can be challenging but it presents clear advantages in class organization as well as monitoring the pace of the course. Adopting PBL methodology will help transform the transmission-oriented classes into more dynamic and interactive ones.

In terms of future use of PBL methodology, authors would advise to thoroughly plan the activities involved as far as the student's skills are concerned. This would imply a sound knowledge of students' personal abilities as well as a creative approach to the methods and resources applied in each project. Providing updated bibliographic sources is also required and organizing the venues and the contexts for sharing the information in digital media platforms can determine the success of the project. Teachers who are planning to apply PBL methodology in their classes should be aware of the high level of commitment, organizational skills, workload, digital competence and resources involved. The outcomes, however, shall be extremely innovative and rewarding in terms of originality, creativity, learners' engagement and methodological breakthrough.

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10

PBL for Integral Human Development

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CHAPTER 10

PBL for Integral Human Development

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1. Introduction

As a result of working on the project *Restart for Education in a Digital Era through Project-Based E-learning (Restart4EDU)* project, financed by the EU through the Erasmus+ programme, aiming to train academics in designing, implementing and evaluating teaching units through Project-based learning (PBL) (https://www.pblworks.org/what-is-pbl) method and the ideas of Backward Educational Design and Design Thinking (Gârțu, 2022; Wiggins and McTighe, 2011), this student-centred form of instruction has been experienced in the context of integral human development since the beginning of the academic year 2022. The five projects presented here have been carried out having in view PBL as a student-driven, teacher-facilitated approach to learning

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but related to integral human development can be an innovative concept in the education process.

In this study, the holistic development of future teachers was considered based on the relationship between the philosophy of Integral Human Development and PBL method. With the philosophy of creating an inclusive education community based on the principle of education for all and equal rights, the diversity of needs and learning abilities were considered. Since the main objective of project-based learning is to produce a product or artifact by working together in a team to execute the project (Ramos, 2014; Esch, 1998) and by exploring what happens to students during the project process as can be seen in **Table 1**, the result is the integral human formation anchored in four inseparable dimensions, which must be articulated in the didactic proposals and practices, namely Work, Culture, Science and Technology, which "[…] are established as an axis from which the meaning can be attributed to each component curricular and based on what meaning can be given to each concept, each theory, each idea" (Brasil, 2013).

2. Presentation of the Projects

Before presenting in more detail the five projects with their specificities of the methodology involved, an overview of them can be summarized in the table below:

Table 1. An overview of the five projects carried out during 2022 (continues in the next page).

	Class	Number of Students	Driving question	Examples of the projects
1	Pedagogy of Primary School and Pre-school Education within English as a foreign language (EFL)	25 students	What is representative for my teaching career?	1. The impact of junk culture on children's education, 2. Speech and learning disorders in the school-age children, 3. Universal children's day, 4. 21st century Teacher, 5. The effects of media on children's education, 6. Inclusive classroom)

	Class	Number of Students	Driving question	Examples of the projects
2	Degree in Psychology (Course – Behavioral Cognitive and Constructivist Models)	60 students	Considering the results of the study "Mental Health in Times of Pandemic in the Portuguese Population", what can be the contribution of implementing Mindfulness-based interventions?	Podcasts "FullMind University: How Mindfulness Can Help College Students' to Face Anxiety Problems" "Smoke(less): "Mindfulness for smokers" Blogs "Mindfulness Parenting" "Teacher's Tutorial" Brochure "Mindfulness: Preventing Stress in University Professors"
3	Physical education	40 students	How does physical education exert formative valences?	1. Creativity and diversity through play and movement 2. Unprecedented motor sequences for educating children's motor qualities 3. Fun application courses for the formation of children's motor skills
4	Music (Bachelor) and Art of Musical Education (Master)	40 students	Teaching and implementing music in the educational environment (general and vocational)	Collecting or composing musical pieces which involve the playful aspect Musical pieces, the games and the interaction through song and play
5	Pre-service Mathematics Teachers	16 students	How do you support healthcare workers who are tired during the pandemic process?	Extraordinary Solutions for Extraordinary Problems
		16 students	What can be done for primary and secondary school students who have deficiencies in knowledge and concepts during the pandemic process?	
		34 students	What can be done to raise awareness about increasing digital addiction and substance abuse during the pandemic process?	

2.1

Reflecting about some of the integral elements in my classes of English as a foreign language, a question seems to be arisen, *What educational experiences can be potentially transformative and what kinds of "material" can be transformative?,* the answer has come by observing and engaging my students in this specific learning process, called Project-based Learning (PBL), an effective way of engaging in simultaneous acquisition of language, content and skills. Inspired by the PBL framework made by Jane-Maria Harding Da Rosa (2018) a PBL framework has been designed for an EFL class and for a **target group of students** in the 2nd year of study, Faculty of Psychology and Educational Sciences, Specialization Pedagogy of Primary School and Pre-school Education (future kindergarten and primary school teachers).

Starting from the **driving question**, *What is representative for my teaching career*?, the target group of students through their collaborative work, access to **authentic sources** such as university syllabus, scientific articles and Internet resources and through teacher's language input, has come to different topics turned into **teams' projects** (*1. The impact of junk culture on children's education, 2. Speech and learning disorders in the school-age children, 3. Universal children's day, 4. 21st century Teacher, 5. The effects of media on children's education, 6. Inclusive classroom*). Since the **learning objectives** have been set-up in the form of – language proficiency – 21st century skills – awareness of CLIL (Content and Language-Integrated Learning) – and all the activity planning has been done, the actual research has been carried out – the development of the content elements, including making materials (the materials and equipment used, the method and the project plan) and leading to some amazing final products or **learning outcomes** embodied in PowerPoint presentations, YouTube videos, posters, questionnaires, illustrations, even methodological tools for identifying people at risk of diagnosing specific language and learning disorders.

On the whole, the students had a **very positive perception of PBL** as an approach. In terms of the four basic language skills, the respondents of the feedback questionnaire rated PBL to have the greatest impact on improving their reading skills. This is followed by speaking, listening and writing skills.

2.2

In the Portuguese context, PBL was applied in the 3rd year of the 1st Cycle of **Psychology**, in the course unit of Behavioral, Cognitive and Constructivist Models. The application focused on one of the psychological intervention models that are addressed in this curricular unit, namely Mindfulness, it involved the participation of 76 students, with a duration of one month. In this time there were 5 face-to-face tutorial meetings with groups of students, with predetermined periodicity and timing. Within the scope of this project, the following **objectives** have been defined:

1. Develop theoretical knowledge about Mindfulness: historical, epistemological and conceptual bases; conceptions of psychological functioning and development and the genesis of psychological dysfunctionality; processes of psychological change activated by psychological intervention strategies characteristic of this model.
2. Development of the ability to apply the model to specific problems and groups, for which there is empirical validation (know-how).
3. Develop skills of practical application of some of the elements of the model.

Regarding the ITC used by students during this project, we can highlight: Moodle (teaching support platform); Ebsco data base (where students carried out bibliographic research); presentation support software (Power point, Canvas). Within the scope of each specific work and according to the tool built by the students, they also had the opportunity to use podcasts, videos, and blogs.

In terms of the **products** developed by the students, at the end of the project two group intervention proposals, a brochure and 10 podcasts were produced, most of them with video. Each tool aimed at a specific population such as teachers, parents, higher education students, smokers and others, for whom *Mindfulness* strategies were proposed that could help prevent/ remedy mental health difficulties. The rationale and architecture of each product was presented in the form of a digital portfolio.

In terms of **evaluation of the process**, the first and main point to highlight would be the motivation, involvement, and investment of students throughout the process. In the classroom meetings they always

had high attendance and active participation in the large group debates on the general theme as well as in the group discussions about the work.

by the products already described.

Student feedback all throughout the process was very positive. In the evaluation made by the groups at the end of each meeting we registered the most used terms: "challenge", "curiosity", "dynamic", "and interesting". In the group' evaluation after the delivery and presentation of the project, the evaluation was also very positive. Beyond the expected academic skills, the students were able to further develop and use their skills of being autonomous, being creative, and being able to use ITC.

2.3

In this context, **Physical education** exerts formative valences on all three dimensions starting with the psychomotor, psycho-emotional and mental dimension In this sense, in the application part, two variants of the method were approached as follows: The first option, the students were divided into 4, 6 or 8 groups and had to complete some motor themes given that each of them can participate and contribute sequentially to its realization through an optimal involvement. Those topics were either basic or applied motor skills or basic motor skills for preschool and primary school.

The second variant consisted in proposing 8 themes of projects of theoretical-applicative character. Thus, 4 groups of 10 students were formed and each group chose a theme. The realization of the homework involved both a theoretical part that could be done on the basis of a power-point presentation and then it was passed to the practical practicing the respective movements.

The objectives pursued were, to form interaction skills and group work, to pursue and engage in the realization of motor themes, to identify the main features of organizing and practicing the respective movements.

The products obtained following the application of these two variants of the PBL method were the following:

- Designing and applying new means specific to physical education based on creativity and diversity.

- Realization of unique motor sequences that have been filmed, posed, processed and represented graphically in different materials such as papers or power-point presentations.
- Publication of a mini-brochure with all these materials and means obtained following the application of this method in the two variants in the discipline of physical education and sports.

From the same integral perspective, physical education forms working skills and interaction in teams, in groups, in pairs aiming at an optimal participation of all the members involved. The **feedback from students** was a positive one in terms of efficiency of motor interactions, individual and group involvement reflected in competitions.

2.4

The present research, the application of the learning method based on PBL projects in the field of Music, was conducted on a sample of 40 students, specialization in Music (Bachelor) and Art of Musical Education (Master). **Music**, through its four essential features – pitch, rhythm, dynamics, and timbre – is the field that facilitates the learning, awareness, optimization, healing and spiritualization of the human being. Thus, music is the discipline that offers the possibility of a quadruple and harmonious formation and employment of the student in his / her evolution: cognitive, emotional, physical, and spiritual.

By teaching and implementing music in the educational environment (general and vocational), the specific skills are outlined, those that emphasize the artistic-aesthetic-creative side of young people, so important in an optimal, multilayered development. Gradually and simultaneously, through **musical education**, young people develop cognitive and emotional skills, by integrating the three attitudes of manifestation of music: reception, interpretation, and creation.

The students were divided into ten groups and experimented, similar to creative workshops, with musical pieces collected or composed by them, which involve the playful aspect, necessary to outline cognitive and emotional skills alike. The second stage followed, that of concretizing the musical pieces, the games and the interaction through song and play, in thematic projects, by emphasizing the theoretical aspects. **The objectives of the project,** in order of their importance, were as follows, a) stimulating and training the ability to work in a team; b) the possibility to find methods for the implementation of music

in the educational framework, as attractive and beneficial as possible for the psycho-cognitive development of young people; c) to encourage young people to express themselves with confidence and motivation, by expressing the manifest attitudes of music: receiver, performer, creator; d) cultivating the aesthetic-artistic-musical-cultural spirit, so necessary for a balanced society. As for **the products made** following the application of these two variants of the PBL method highlighted original materials, unique group creations: harmonized musical pieces, work in music programs, Sibelius, MuseScore, audio recordings, essays, PowerPoint presentations. In terms of **the impact on students** was beneficial and constructive, as PBL-based research gave them the opportunity to reveal an active learning and research environment, in the team, the belief that music is a field of reference that ensures a complete and harmonious development. Their feedback is affirmative and encouraging through this method, they notice the development of some attitudes, personal abilities: engaging in promoting their field of reference – Music, (re) discovering inner resources, motivation, understanding the cognitive-emotional sphere,ccompliance, adaptability, creating an overview, sharing research and results for the good use of others.

2.5

The **scope of this research**, which is based on PBL learning method "Values Education" for secondary school **pre-service mathematics teachers**. The project was created with the philosophy that secondary school mathematics pre-service teachers should be trained as teachers who are aware of the different problems they will encounter in the society and/or in their schools, are sensitive to social problems, and can raise their students with this responsibility and awareness, rather than just being teachers who solve only mathematical problems in their future professional life. First of all, the pre-service teachers were asked to find an "Extraordinary Problem" that we encounter in real life in society and to think about how they can contribute to possible solutions by brainstorming with their group mates. There came many ideas (Knowledge is universal, so is kindness; Mathematics is like a game; If you make it beautiful, the world becomes beautiful! Life at home, taste in the family!; Faculty-School Cooperation) from the pre-service teachers. The studies were carried out within the scope of the the main project of "Extraordinary Solutions for Extraordinary Problems" which has three sub-studies. The details of the three selected sub-studies are given

here. The first sub-study of the extraordinary problems identified by the pre-service teachers was the Covid 19 epidemic and the difficulties faced by health workers due to this epidemic. The second sub-study is the lack of knowledge and concepts of primary and secondary school students due to the inability to receive face-to-face education during the Covid 19 epidemic. For this problem, a study was carried out to support primary and secondary school students with the understanding of "Support from Far, Care, Knowledge and Love from Near" in problems they could not solve and subjects they could not understand. The third sub-project is "Don't be addicted, be independent!" in which we performed studies on the fight against addiction given under this title. In this context, the issue of combating substance abuse and digital addiction was identified as an extraordinary problem, and studies aimed to increase social awareness about this problem, to take precautions and to provide appropriate guidance. **Participants' feedback** and competencies were examined in these studies, which were carried out by focusing on PBL and Integral Human Development / Human-Centered Development perspective within the scope of "Community Service Practices Course". The competencies obtained from the students' feedback were examined according to the ATC21S framework (Griffin, Care & B. McGaw, 2012) and the findings showed that all of the pre-service teachers were of the opinion that this project contributed to the issues of cooperative work, group work and being responsible for the society as a teacher. The issue of solving social problems has also been an opinion expressed with problem-solving skills. It was determined that the pre-service teachers have opinions that this study contributed to their pedagogy and technology knowledge through experience.

Conclusion

Proponents of integral education believe that the defining elements of student psychology and human development – curiosity, confidence, interest in the activity, personal expression, courage, love, openness, good mood – influences the process of education in which the student is a value and emphasizes contextualization, concretization and globalization. The paradigm shift determines the foundation of some learning models through authentic educational contexts, such as PBL, ensuring the development of the efficiency of educational practices.

On the other hand, from the experiences in class, there are some disadvantages that should be considered, such as special time for organization, development, students' loss of focus on what they are doing if the duration of the project is too long or the topic too uninteresting, and last but not least, students may have problems with reaching the completion deadlines (on the first project, having no experience at all, they progressed more slowly, synthesized their information more difficult, for which they even tried to get an extension of the deadline for supporting the project in front of the class).

Our proposal is that we should not stick to a one-size fits all PBL approach, but adapt and redesign PBL and other approaches based on the theory of integral education. At most, the approach of integral education can help us gain better insight into why PBL with certain characteristics, preferably based on theory, might work in a specific context with particular goals in mind. The theory can help us explain how complex phenomena in PBL interact and thereby add to our understanding. PBL needs to be continually redesigned in line with current and newly emerging theories. PBL is highly context-specific and needs to be reinvented again and again given that its context is not fixed, but changes continually.

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11

Applying Project-Based E-Learning with Vulnerable Groups: An Intervention Proposal for Older Adults, Students with Disabilities, and Roma People

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CHAPTER 11

Applying Project-Based E-Learning with Vulnerable Groups: An Intervention Proposal for Older Adults, Students with Disabilities, and Roma People

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1. Introduction

For many years, attempts have been made to define the concepts of social exclusion and poverty in various fields, such as economics and social science. Social exclusion results from the inability of some groups to benefit from services such as education, health, information, and communication technologies, and also their inability to participate in decision-making processes, cultural activities, and work activities. Social exclusion is mostly directed toward the existing disadvantaged groups in society. Individuals in disadvantaged groups cannot access or have difficulties in accessing the same opportunities that the general society has on issues such as health, education, obtaining information, and in social relations (Mayer, 2003).

Since this chapter has contributions from researchers from different countries it should be noted that, over the last few years, the authors have been developing different studies and coordination functions within the scope of aging (Vieira da Silva & Monteiro, 2021; Vieira

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da Silva & Rodrigues, 2022) children with disabilities (Cavkaytar et. al., 2014; Melekoğlu & Sönmez Kartal, 2019) and Roma people (Moreira et al., 2022; Rosário et al., 2017). It is important to highlight that vulnerabilities have a symbolic component. In other words, their identification is variable in time, culture, and according to individual character, such as terms of gender, family, work, and generation (Fernandes & Garcia, 2010).

Vulnerability results from different circumstances. Based on this premise, not only the biological perspective stands out (e.g., aging; health problems; inaccessibility to health services), but also the social perspective (e.g., lack of support networks and family support; losses; isolation; level of education) needs to be considered.

Overall, vulnerable groups consist of different groups who are most likely to face the threat of poverty in society. Of the complexity and diversity of vulnerability, the present chapter addresses three specific vulnerable groups, i.e., older adults, children with disabilities, and Roma people.

In the context of Applied Social Gerontology, the concept of vulnerability should be explored subjectively. From this point of view, various contexts and circumstances may influence the quality of life of citizens, namely in terms of physical dependence, social isolation, and life experiences (Barbosa et al., 2019). Thus, it is important to highlight that the aging process may contribute as a determining factor for poverty and vulnerability (e.g., retirement; decrease in functional and cognitive abilities; late contributory careers; workers in rural areas; low levels of education) (Lopes, 2015).

Regarding children with disabilities, they are also considered as one of the vulnerable groups. According to the World Health Organization (2022a, 2022b), more than one billion people with disabilities live in the world today. These people often have worse health, lower educational attainment, fewer economic opportunities, and higher rates of poverty than people without disabilities (Lid, 2015). This is largely due to the difficulties they face in their daily lives rather than their special needs. Children with disabilities struggle to benefit from educational services and participate in sports, physical, leisure, and recreational activities (Murphy et al., 2008). Many children with disabilities are still, to a large extent, socially segregated and experience negative societal stereotypes and low-performance expectations, rendering them limited opportunities for participation in group activities (Karakan, 2018). Special needs cause poverty by restricting access to education and

employment in later life and thus lead to economic and social exclusion (Department for International Development, 2000).

Concerning the last vulnerable group, we proposed to address, "Roma", "Gypsies", or "Travelers" are terms used to refer to groups of people that share cultural characteristics despite having their own identity (Frazer & Marlier, 2011; Rosário et al., 2016). Since the present handbook has contributions from different countries, we will adopt the term "Roma" as it is widely used in international literature. Roma people have been persistently facing social exclusion, poverty, and limited access to welfare aids in key livelihood areas, such as education (Moreira et al., 2022; Rosário et al., 2020). Despite the international policies efforts, dropout, absenteeism, and school failure rates are still high and persistent concerns for stakeholders (Rosário et al., 2020). Thus, the mentioned factors may contribute to the Roma people's vulnerability and hardships.

These perspectives highlight that it is imperative to appeal to these vulnerable people to participate in physical (McPhee et al., 2016), social (Gao et al., 2018), recreational, and educational activities (e.g., digital literacy) (Rosário et al., 2016), leading to feelings of belonging and inter-generational bonds (Cara, 2000; Delman-Jenkins, 1997; Murphy et. al., 2008).

2. Applying Project-Based E-Learning with Vulnerable Groups

Project-Based E-Learning **(**PBL) is a learning methodology that allows students to experience authentic challenges and technology (Guo, 2020; Kokotsaki et al., 2016). E-learning-based PBL is important for children with disabilities as well as for other vulnerable groups in the virtual or in-person learning process because it offers teachers a wide variety of teaching opportunities (Bell, 2010; Kokotsaki et. al. 2016) to approach vulnerable groups' idiosyncrasies. Additionally, through adequate technology use (Sindu & Permana, 2021), a driving question, and meaningful content for the vulnerable group, PBL could be an important learning method for the educational process of these groups.

PBL has been widely used across different countries for various purposes such as to train computational thinking (Hsu et al., 2018), to promote social skills (Kazun & Pastukhova, 2018), and with differences in the outcomes. For example, Chen and Yang (2019) carried out a meta-analysis about the effect of traditional learning and PBL on academic

achievement. The authors found that student's academic achievement in PBL was influenced by factors such as length of instruction, information technology support, and school location.

PBL empowers students, giving them opportunities to explore and acquire knowledge of real-life situations of vulnerability. In convergence with Kim (2020), we believe that PBL will not only allow the adoption of a new methodology but also the development of key skills (e.g., empathic; communication), through meaningful experiences with people with different origins and backgrounds. In this regard, the authors showed the effectiveness of PBL for both elder adults as well to train students to work with older adults (Hanklang & Sivasan, 2021; Hausknecht & Kaufman, 2018). For example, Hausknecht and Kaufman (2018) successfully used the PBL methodology to convey a digital storytelling course to improve the digital skills of older adults. Hanklang and Sivasan (2021) confirmed the effectiveness of PBL, confirming that through this approach, students gained competencies to work with and know how to care for older adults in the community. This study shows that this PBL approach is likely to benefit students with lower empathy in developing their empathic skills. Similarly, children with disabilities and Roma may easily learn cultural characteristics and complex concepts such as empathy through PBL.

Academic outcomes of Roma children are highly influenced by contextual (e.g., educational policies, Moreira et al., 2022) and cultural factors (e.g., high level of autonomy amongst children; not waking up the children; Rosário et al., 2017). In this respect, PBL may be a valuable tool considering it helps promote autonomy and proactivity (Kokotsaki et al., 2016; Messing, 2008). According to Messing (2008), PBL is amongst the most useful methods to promote inclusion with children of ethnic minority backgrounds.

Similarly, providing e-learning materials and support services that are adapted to students with disabilities provides obtain maximal benefit to them (Douce et.al., 2010). For instance, Ilijoski and Ackovska (2022) developed a Project-Based Learning Approach at Human - Computer Interaction Course. In this course, they created an "interactive picture book" which is an educational mobile and web application designed for children with autism that through nonlinear stories and conversations should help children with autism understand emotions, animals, shapes, and colors. This kind of project makes students with disabilities more active members of society and increase their knowledge. Thus, PBL makes life easier for these children, their parents, and their teachers.

The use of digital technology in PBL could be an opportunity for sharing new educational tools and platforms (Sindu & Permana, 2021), including the participation of these vulnerable groups in society through the promotion of their digital literacy.

3. Our proposal

A project aligned with the PBL methodology, involving teachers, students, and vulnerable groups and designed to intervene and provide answers to real-life problems is extremely relevant. Damianakis et al., (2010) refer that storytelling is a therapy with very significant results for citizens with dementia. In this logic, Kong et al. (2022) refer that a storytelling methodology is a pedagogical method that may meet the needs of older people. In this sense, aspects such as the lack of literacy, improved well-being, and training for caregivers may be added value and health gains. In this way, customized educational programs can be offered to the most vulnerable citizens.

Stenhouse et al., (2013) refer that storytelling through technology should be called digital storytelling. According to the authors, a digital narrative should have short videos, with a sequence of images and photos, music, videos, and narration or written text, to transmit a message to different audiences. From this point of view, the use of digital narratives with vulnerable people could be a useful tool to promote social interaction. Topics can range from biographical routes to their conditions such as health problems, dependency, learning difficulties, etc. (Rios Rincon, 2022).

There are many ways to use PBL and this proposal focuses on some activity-based learning strategies such as using music, drawings, and digital storytelling. To contextualize this project, older adults, children with disabilities, and Roma have low levels of literacy, and often, have few opportunities to work with information and communications technology (ICT) tools. Thus, the present PBL proposal aims to promote training in digital skills with these vulnerable groups.

Driving question: How to intervene and provide answers to real-life problems of vulnerable groups' integration into society?

Goals: To promote social integration of vulnerable groups through Project-Based e-Learning strategies.

Examples of Strategy: As part of the RESTART4EDU, a PBL project was carried out with special education pre-service teachers. The

name of the project is *"Learning Cultural Artists and Values with Sign Language"*. In the project, to teach children with hearing disabilities a culturally significant song by an important artist, content s created in the classroom context by singing in sign language that was, afterward on YouTube with the permission of pre-service teachers who created the video material (https://youtu.be/mo8bZl1BJio). Thus, pre-service teachers learned the strategy of teaching intangible knowledge such as cultural heritage to students with special needs in a fun way.

Figure 1. QR Code of the Project Video About Sign Language

In another experience created in the context of the RESTART4EDU Project (in the Social Work History curricular unit), students applied innovative technological methodologies as is the case of Flipgrid. Flipgrid is a video discussion app used by learners and educators looking to ample student voice and empowers learners of all ages to engage and share using the power of video.

In this sense, and based on these projects created in the context of the RESTART4EDU Project, the present proposal could replicate the work with the other vulnerable groups. Through various art forms (e.g., music, literature, mobile apps) higher education students will seek to work towards the inclusion of these vulnerable groups.

Class	Number of Students	Driving Question	Examples of the Projects
Field of special education	55	– How to teach cultural values to students with special needs	**Creating Video Material:** In the video, pre-service teachers singed a culturally significant song by an important artist in sign language to teach cultural heritage to students with hearing disabilities. After that, they published it on YouTube.
Social Work History	33	– How to empower first-year students through original initiatives (creation and presentation of the scientific poster; use of digital teaching platform; English skills improvement) leading to reflect the importance of social work pioneers as a contribution in the fight against poverty and social exclusion (namely children).	**Poster Presentation:** Each group was responsible for creating a scientific poster and presenting it at a Seminar organized by Catholica University: "World Social Work Day 22". Their communication during the Seminar was the student's first experience of oral exposition, as well as the realization of a scientific poster (Students were entitled to a certificate of participation and communication). **Creativity:** After watching the film "The Courageous Heart of Irena Sendler" students had a new task: Through the Flipgrid application, students should reflect on the life of Irena Sendler and her contribution as a defender of children's rights. Also, since a significant part of the students reported having difficulties speaking in English, the video presentations were in English, to promote new skills.

Table 1. An Example Project.

ICT resources	Video editing software. Presentation software. Zoom. Music, literature, narration, and drawings (in digital form).
Products	Digital Storytelling. Written report.
Global appraisal	It is expected that students explore and discover the knowledge of authentic situations of vulnerability. It is expected that students develop communication skills, cooperative learning, autonomy, creativity, and critical thinking.

Conclusion

Our aim with this chapter was to explore how PBL could be used to help promote awareness about vulnerable people's challenges while contributing to their social integration. In this sense, our PBL proposal may be applied through ICT tools (e.g., storytelling, apps, podcasts) contributing to the citizens' integration concerning their vulnerabilities (e.g., health problems, digital illiteracy, cognitive disorders, learning difficulties).

PBL has the potential to revolutionize learning as it enables students to experience challenges in person and prompts the development of coping skills. In a time where students are demanded to be proactive about their learning, and develop their critical reasoning, and communication skills, promoting knowledge about vulnerable groups may contribute to practices of empathy and diminish discrimination and social exclusion towards them. On the other hand, promoting ICT skills amongst these vulnerable groups may enable them to be more capacitated to face the widespread challenges they face and that puts them at risk for poverty and social exclusion.

The results of the PBL projects are described in Table X.1. suggest that this is a methodology with very significant results, where through creativity, students are empowered to solve a real-life problem. The application of this methodology through ICT tools (i.e. Youtube and Flipgrid), allowed the dissemination of the educational experiences to different students and teachers who participated in the Summer School in Eskisehir. It was based on the different experiences that we have now been able to present a new proposal for students to work with vulnerable groups.

We hope this approach may drive practitioners, educators, and other key stakeholders to apply PBL with vulnerable groups and advance research on this topic.

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12

PBL as a Tool for Fostering Refugee Studies in University Education

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CHAPTER 12

PBL as a Tool for Fostering Refugee Studies in University Education

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1. Introduction

The refugee crisis has been a major global concern for over a decade. Refugees face numerous problems in the host countries, and this new social outlook has also challenged host countries. The research shows that refugees face several problems in the educational environment, including language barriers, discrimination, lack of academic knowledge, and child labouring (ERG, 2018). Host countries have also struggled with including refugees in the educational system, health care, social life and legal processes and finding a way to ensure their active participation. Social work studies and education might have a significant role in integrating refugees into schools and society.

The strong manifestation of the refugee problem in societies has brought along some new searches in the content and methods of education (Nieto, 2017). Different methods that enrich educational environments can contribute to focus on finding solutions for the refugee crisis in different areas. In particular, approaches such as Project Based Learning which supports the active participation of individuals, makes it

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possible to examine problems in depth and develops problem-solving skills, can make significant differences. Hallermann et al. (2011) state that with its systematic teaching model, PBL helps students to meet 21st-century skills and assists them to create their own investigations about complex problems. This chapter aims to present both a PBL experience in the area of Religious Education in Turkey and an ongoing interdisciplinary and international PBL experiment involving Religious Education students from Turkey and Social Work undergraduate students from Portugal.

2. PBL and Refugee Studies

Jones and Rutter (1998), taking the English context as an example and state that refugee education and their problems are as old as education, especially since the 16th century. Since then, their presence has remained continuous. However, it is only recently that we have seen a growth in research focused on the education of students from refugee backgrounds (Shapiro et al., 2018).

Universities are vital for promoting common well-being, social solidarity, and righting social inequalities (Naidoo, 2018). For example, programs and partnerships with NGOs improve refugees' lives and employment prospects (Sork & Boskic, 2017), fostering their integration into society and raising civil society's awareness of their support and reception. In this regard, theoretical and technical knowledge must be mobilized with the involvement of teachers and students. That implies moving from traditional teaching methodologies to active methodologies that ensure a high level of student involvement. Among the active teaching-learning methodologies, PBL stands out but there is limited literature relates PBL to the topic of refugees.

The literature review shows that there is limited literature for refugee studies. These studies refer to the use of PBL with the involvement of refugees (Bolon et al., 2020; Sork & Boskic, 2017; Turkawka et al., 2019) or thought to improve the living conditions of refugees (Akilova et al., 2021; Barrios-Padura et al., 2019; Poldma, 2016; Terrón-López et al., 2020). This literature demonstrates the opportunities that technology can offer not only to the students involved in the experiences but also to the work of education and integration of refugees using distance learning.

Investing in integrating refugees is a growing concern based on a broad notion of rights (e.g., the right to employment, education, and health). In pursuing these objectives, higher education institutions can contribute to developing projects that respond to the problems and needs arising from refugees crisis. The literature review also shows concerns about social welfare (Simson et al., 2021), the satisfaction of individual and community human needs (Hemmati et al., 2017) and addressing the social challenges brought by the humanitarian refugee crisis (Barrios-Padura et al., 2019; Poldma, 2016; Sork & Boskic, 2017).

In this sense, the implementation of project-based learning methodologies contributed to empowering students in the design and implementation of activities that improve the social inclusion processes of refugees (Akilova et al., 2021) in the areas of education and employment (Sork & Boskic, 2017; Turkawka et al., 2019) and access to quality health care (Bolon et al., 2020). Furthermore, the involvement in social activities or projects with refugees, specific support and academic guidance appropriate to humanitarian contexts promotes the acquisition and development of relevant sustainability-related skills and prepares university students for their professional future through the acquisition of basic 21st-century skills (Botella Nicolás & Ramos Ramos, 2021; Dooly et al., 2021) like communication, collaboration, critical thinking, responsibility, decision-making and creativity.

3. A PBL Experience in Refugee Studies

Refugee studies try to deal with complex problems which refugees and citizens of host countries face during the interaction to each other. It is possible to encounter these problems in every moment of life such as education, health, accommodation, social services and daily life. For this reason, professional groups such as teachers, health workers and social workers, who are likely to encounter refugees should be included in the handling of problems concerning refugees. It is a requirement that individuals who attends university-level education in these areas should also specialize in subjects such as refugee studies, multicultural life, multicultural education environments, social services and refugee relations. This fact should bring along the rethinking of university educators about the content of education, the education method and the student competencies that need to be developed. It can be understood that it will be beneficial to add content and application areas about refugee

studies to the faculties that train teachers and programs that train social workers.

At this point, it would be useful to include an example of PBL practice in refugee studies and the experiences of an instructor. The project which implemented in Eskişehir Osmangazi University Faculty of Theology by Aybiçe TOSUN aims to enable religious teacher candidates to feel more competent in creating multicultural environment in religious education and include differences in the teaching and learning process. During the learning journey teacher candidates got a chance to focus on the refugee studies with their own context and conduct their own researches about it. After determining problematic areas in education the process lead teacher candidates to create their own lesson plans and design materials in such multicultural learning environments. Teacher candidates were the core of the lessons and they have asked to give presentations and share their research results and own designs in regard of multicultural learning environment. After this experience we believe that PBL with refugee studies will develop teacher candidates' competences and allow them to share their own voices in the planning of the lessons. 6 teacher candidates have participated to PBL and they indicated in the focus group interview that; they came to an understanding about the importance of creating fruitful learning environments for refugees for their social integration. The also stressed that PBL method gave them an opportunity to create valuable lesson plans for multicultural environments. This experience is used a base for international joint PBL project during the Summer School of Restart for Education between Eskişehir Osmangazi University Faculty of Theology (ESOGU-FT) and Faculty of Philosophy and Social Sciences of the Portuguese Catholic University (FFCS-UCP).

We specify the main question is "How can we integrate refugees into society?" The new PBL educational experience has twenty-four social work students from the FFCS-UCP divided into six working groups. The project implementation time is 14 weeks from October 2022 to March 2023. Table 1 summarizes the PBL developed concerning the PBL Gold Standard, in particular, the seven essential project design elements (Larmer et al., 2015).

Elements	Accomplished (FFCS-UCP)
Driving question	How can we integrate refugees into society?
Sustained inquiry	Literature review
Authenticity	Identification of authentic contexts for project implementation (e.g. schools, universities, NGOs, municipalities), Design of creative, feasible and conducive intervention activities with the practice of social interventionists (e.g., social workers),
Student voice & choice	‣ Sharing students' perceptions of refugees and personal experiences with refugees. Practical exercise "Sense-seeking" (empathy training). ‣ The students were divided into smaller groups that shared common interests (the teacher played the role of minor adjustments).
Reflection	‣ All work sessions of the small groups involved moments of reflection with the teacher
Critique & revision	1st moment - draft of the project
Elements	Ongoing or foreseen (FFCS-UCP and ESOGU-FT)
Critique & revision	‣ 2nd moment - a revision by experts (Portugal and Turkey) ‣ 3rd moment - feedback on the revision for improvement of the student's work ‣ 4th moment - completion of the projects for public presentation.
Public product	‣ International webinar for all students and university to share experiences in PBL. ‣ Dissemination of the work (e.g., libraries, NGOs and on the internet).

Table 1. Gold Standard PBL - The seven essential project design elements.

The PBL we present has as its primary learning objective to develop an awareness of cultural and religious diversity as fundamental for better integration of refugee people. In addition, it prepares students for the knowledge and defense of human rights and the ability to mobilize social policies for the social integration of refugees. As expected results, creating guidelines and definitions of strategies for integrating refugees are fundamental.

With this methodology, we expected students to acquire technical, personal and social skills (communication, relationship, ethics, teamwork, adaptation, critical thinking, autonomy and creativity) that will enable them to intervene with refugees. This PBL allows teachers to develop curricula to promote knowledge and student learning in contexts of social integration of people at risk and social vulnerability, as is the case of refugees, responding, in an academic context, to real problems that concern contemporary society.

The integration of refugees is a concern for many countries. Professionals like social workers have a crucial role in the welcome and integration of refugees, ensuring primary human conditions, defending human dignity, and promoting social rights (education, housing, health etc.). In fact, with the growing migration crisis at a global level, it is necessary to have adequate training that enables social workers and teachers to understand cultural differences, religious diversity and develop skills in the context of sustainability.

Conclusion

During the ongoing PBL project we came to an understanding that; the essence of PBL lies in the development of social and educational projects, which have an impact that goes beyond the classroom, because they involve collaboration between students and refugees in finding solutions to real problems of social integration. The use of PBL can contribute to the integration of refugees in schools and society by balancing the acquisition of knowledge with the development of skills. Students are encouraged to autonomously develop research on culture, religion, and human rights. In this way, students can create and awareness of the principles of humanism, solidarity, ethical issues, multiculturalism, religious diversity and tolerance and the defense of human rights in a global risk society.

PBL, apart from developing initiative and teamwork skills, simultaneously brings the students closer to the social-economic and political contexts and students have the possibility to contact professionals and integration projects promoted by NGOs, identifying problems and good practices, understanding their needs, and knowing their motivations and future perspectives. This enables students to articulate theory and practice, stimulating them to face challenges and problems related to their field of knowledge with flexibility, innovation, and entrepreneurship.

Project-based learning offers opportunities to improve social work learning, motivating students to identify and strengthen their skills, through practical projects, in solving real problems. We believe that, through PBL, students are not only involved in the application and development of theories, skills and techniques to solve problems of social integration experienced by refugees but also gain experience in developing these skills in contexts of risk and social vulnerability, transferring what they have learned to future projects within the scope of social work intervention. In this way, PBL, arising from the fusion of knowledge with skills and oriented towards solving the initial question, encourages students to create products that contribute to the design of guidelines for the social integration of refugees.

We recommend to higher education professionals to use PBL because;

- PBL should be considered as a useful tool to improve students' understanding of the immigration and refugee studies.
- Students' active participation in the learning process through PBL develops their worldview towards others.
- With PBL, students are able to find practical solutions to the complex problems faced by immigrants.

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13

Strategic Analysis of PLB Methodology using SWOT Matrix

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CHAPTER 13

Strategic Analysis of PLB Methodology using SWOT Matrix

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YILMAZ SEVER [e]

1. Introduction

As a student-centered approach among others (inquiry-based, problem-based learning), PBL is the most exciting and the most applicable method nowadays. To give to the student a central role in the play is not that simple as it seems: teachers are required to redesign and rethink old methods and strategies, focusing on creative thinking, collaboration, and a broad vision to raise and maintain the classroom involvement. As a practical teaching strategy, it has become quickly the most useful tool for medicine, sciences, engineering, math (STEM) and lately, it has been demonstrated the use of PBL in literature and social sciences (Duke, Halvorsen and Strachan, 2016). However,

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according to researchers, a causal link between project-based learning instruction and positive student outcomes cannot be established with certainty" (Kokotsaki, Menzies and Wiggins, 2016). Despite the vast literature, articles and scientific papers dedicated to PBL, one phenomenon can be predicted: as PBL grows in popularity and success, it is expected to gain more advocates and more problematic aspects will emerge from practice. It is an „open-architecture" (Wrigley, 2007) in continuous development and will challenge larger educational communities, resulting in more diverse and significant scientific papers. In this line of challenge and practice, all the authors of this research mentioned above were part of the Restart for Edu Programme, being trained over six months, through online courses and one on one experience. Switching roles, from target group to trainers, was the second major event and led to a genuine perception of the benefits/impediments of PBL application.

Based on this standpoint, the main objective of this research is to develop a strategic analysis of the PBL methodology. Specific objectives include: to assess the opportunities, threats, strengths, and weaknesses of PBL; to make recommendations and suggest actions to improve PBL.

This research had a qualitative approach and an exploratory design and used a non probabilistic by convenience sample of the involved teachers, investigators, and coordinators of the PBL project, from 3 countries: Portugal, Romania, and Türkiye. To collect data, an online questionnaire based on a strategic analysis tool, the SWOT matrix, was use. The results were analysed through a content analysis method that included an *a posteriori* category selection and references counting.

The results will be presented, after the characterization of the respondents, using the SWOT topics: the internal perspective (strengths and weaknesses) and the external perspective (opportunities and threats), as well the suggestions made by the respondents. Based on the results achieved, some conclusions are pointed out and recommendations are made, to improve future implementations of this project-based learning methodology.

2. Data Analysis

36 valid responses were obtained. 71% (25) participated on the experience as a teacher, 14% (5) as a coordinator, 9% (3) as an investigator and 6% (2) as target group [figure 1].

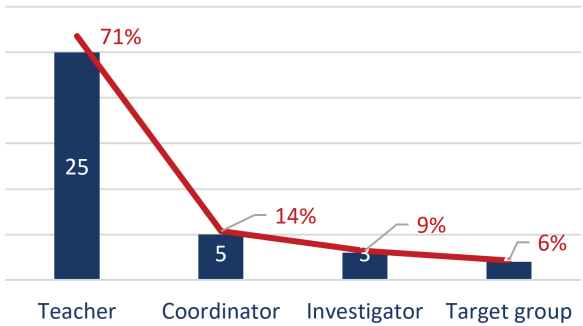

Figure 1. Role in PBL experience.

In terms of the kind of experience, we divided in classes and other projects. Eight have used once this methodology; eleven have already used PBL 2 or 3 times in classes; twelve have used 4 or more times [figure 2].

Figure 2. Experience in using PBL.

The main area of knowledge is Education (13), followed by social sciences, journalism, and information (6); Health and Welfare (4); Engineering, manufacturing, and construction (3); Natural sciences, mathematics and statistics (2); Business, administration and law (2); Sports and physical education (1); Social work (1); Services (1)

Figure 3. Main area of knowledge.

Information and Communication Technologies (ICTs) (1); Agriculture, forestry, fisheries and veterinary (1) [figure 3].

Concerning the distribution among countries, 56% (18) were from Romania; 28% from Portugal (9) and 16% (5) from Türkiye [figure 4].

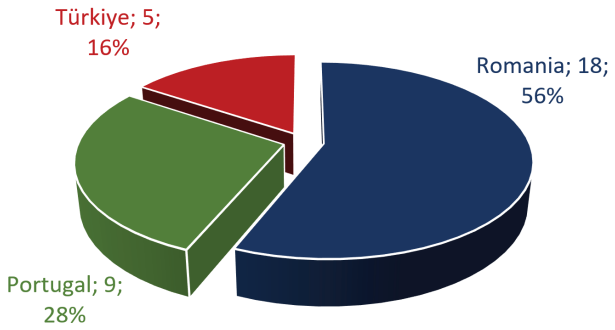

Figure 4. Country.

To analyse the answers concerning the strengths of PBL methodology, the sentences were analysed, and 5 categories emerged. The number of references were then counted. The results are summarized on table 1.

Responses	Category	Frequency
Problem-solving; Creativity; Motivation; Responsibility; Concentration; Patience; Commitment; Time management; Goal seeking; Curiosity; Critical thinking; Engagement	**Individual competences development**	**22**
Teamwork; Interaction; Collaboration Sincronasing. Involvement. Gamming. Learn as a team	**Social competences development**	**17**
Real life experience. It allows to bridge the gap between theory and practice. To identify a real problem to be solved. Theory-practice relationship; Creating meaningful learning environments for students; Learning becomes more meaningful. Development of active learning	**Reality-based and meaningful experience**	**6**
It places the student at the center of the entire learning process (involving in decision making, goal setting, and even evaluation of learning); Student-oriented; It provides freedom to the student.	**Students as the centre of the learning process**	**5**
The closer relationship between teachers and students Closer pedagogical relationship. It increases interaction with the student.	**Pedagogical relationship**	**3**
The rhythm of work; Freedom to set your objectives. The possibility of generating continuous assessment procedures that enhance better learning monitoring and goal seeking. Multidisciplinary learning. Active learning. Innovative practice	**Others**	**6**

Table 1. Participants' replies about strengths of PBL.

To analyse the answers concerning the weaknesses of PBL methodology, the sentences were analysed, and 7 categories emerged. The number of references were then counted. The results are summarized on table 2.

Responses	Category	Frequency
Time required for its implementation; Time-consuming: It is difficult to balance the rigid timetable always defined for each scholar year with the dynamic format of PBL.; Take a lot of time to implement.; Requires more time; Classroom management, time; Requires a lot of time that must be provided to solve complex problems; Will lead to a lack of time available for the material/content.	Time	7
Cannot be applied for all disciplines. Difficult to set up regular meetings; It requires the teacher to carefully plan the stimulus in articulation with the learning objectives of the UC; Hard to implement in non-homogeneous groups; Difficult to implement; Can be differentiated and standardized for different disciplines. Requires strong leadership and experience: The establishment of common Points in projects	Implementation	7
Requires close monitoring of students, review, and feedback from teachers to ensure that the theoretical knowledge (the hard skills) is also and effectively acquired; Requires continuous monitoring of the students and applies most accurately in small classes. With large classes and low feedback, it can have very diffuse effects on student learning. Requires more detailed assessment and evaluation; My classes are so crowd and it takes too much time about giving feedback and following students works. Peer assessment (students appreciate one another with „excellent")	Monitoring and evaluation	5
Working with large groups is challenging but, in this experience, given the involvement of the students it was not the expected problem. I share my doubt - when it will not be possible/ recommended to use PBL; It is not applicable to large classes; It is also hard to give equal time for each student to show their perform. In large classrooms we may find it difficult to provide continuous assessment activities; It becomes difficult to manage the classroom in crowded classroom.	Size of the class	5
Students who are not experienced with working in groups may have difficulty in negotiation and compromise. When students have little initiative. When the topic given to each group is different, it is feared that students cannot understand the topic entirely.	Students	3
It is new for students; for students it is a new methodology and still difficult to apply; Resistance from students.	New methodology	3
Overhead (many needed resources); Requires resources.	Resources	2

Table 2. Participants' replies about weaknesses of PBL.

The 27 participants' comments about the opportunities of PBL were also analysed with *content analysis*. Firstly, the comments were read literally, and emphasis points were coded (as words or sentences) to see frequencies [table 3].

Responses/category	Frequency
Rises student involvement to learning process	8
Give teacher more space to focus on pedagogical aspects	4
A new alternative way of teaching for teachers	4
Adaptable for different disciplines	3
Rises students' creativity	3
Students transform information to the knowledge	3
Facing with complexity of practice	3
Increase motivation	3
Students build their own way of learning and conclusion	3
Inspiring other teachers	3
Developing contemporary competences	2
Promotes self-learning	2
Students reflect themself on products	2
Supports out of school (lifelong) learning competence	2
Cope with technologic problems	2
Sharing course responsibilities	2
Working with others, being a team (cooperation)	2
Using ICT (Information Communication Tools)	2
Developable	1
Enables distance learning	1
Contribute innovative thinking/outcomes	1
Inquiring/searching competence	1
Meet/discover untold problems	1
Managing/ using sources	1
Lets the students do their own evaluations (more formal: Allows students to perform self-assessment	1

Table 3. Participants' replies about opportunities of PBL.

When asked about the threats PBL methodology can face, several were pointed out [table 4].

Table 4. Participants' replies about threats of PBL (continues in next page).

Responses	Category
PBL may be under the threat of becoming a simple project, despite the teacher's good intention. Practice has demonstrated that sometimes teacher is focused on the final products (in most of the cases the final product is a collection of sheets, images, drawings, or power point presentations reproducing information taken from internet sources/curriculum/manuals). These falls are due to the deficient driving-questions formulations, insufficient explanations/understanding of the goal of PBL. Students are not required to find a solution to a real-world problem and they just, google" to find differences or similarities between facts, concepts, definitions and so on. They do not perform a genuine investigation and their results do not respond to the, need to know" desire.	PBL becomes a simple project
Obviously, it is impossible to implement PBL within the frame of a traditional learning-based school/institution, where students are expected to learn as soon as they receive information from a central-figure teacher. These two types of educational philosophy coexist, and it requires a change in educational philosophy if we want to implement PBL. Lack of flexible classroom space.	Traditional approach of education
PBL is confused with problem-based learning: both are centered around real-world problems, but the divergent point appears in the way students explore/ investigate and deal with the outcomes.	Confused with problem-based learning
Because PBL involves a network of practitioners, a collaboration between teachers, is hard to rely just on one person as a head of PBL. Institutions must identify accomplished project-based practitioners and leaders of organizations that promote project-based learning to support each other.	Institutional support and training
Teachers tend to neglect or overlook the importance of formative assessment and pay more attention to summative assessment, ignoring the fact that formative assessment provides feedback and adjusts ongoing teaching and learning. A consistent formative assessment helps students get back on track and a loosen formative assessment may conduct to a false/superficial process of learning.	Weak formative assessment
Some colleague teachers may express concerns about the effectiveness of PBL in front of the classroom, but more often parents are worried about this innovative way of teaching. A less enthusiastic attitude towards PBL may lead to discouragement and lack of pupil involvement.	Lack of trust in its effectiveness

Responses	Category
Rubrics are extremely useful for self-assessment and not only. A neat description for each level helps students in monitoring and evaluating their progress.	Ambiguous rubrics
Curricula is another factor that could impact in a negative to almost impossible implementation of a PBL. Educators and decisional factors are called to design project-based units and project-based curriculum and proceed to project-based instruction.	Curricula
Immature student, lack of prerequisite knowledge, fear, anxiety, need of control and permanent guidance.	Student unpreparedness
PBL effectiveness is compromise when some students do most of the work or some members do not want others to be involved, fearing they will not get the higher mark.	Group dynamics

Suggestions and recommendations to improve this methodology were also asked. The summary of the responses is presented below.

The first suggestion is to use this methodology. Then, colleagues should share their experiences, promoting collaborative work, and always look for advice. To be patient and devote some time to prepare the projects, as well to have training, will lead to positive impacts on the relationship with the students. More support is asked, namely with clearer explanations, pointing out the differences of this methodology compared to other projects management, as well in the use of technological tools. Also, more examples with technology should be provided. Some advice on how to motivate and encourage the students to take part on the project, is also requested. Another subject is about communication, asking for more publicity to PBL achievements. How to assess individual contributions of each student is another demand. Concerning students, a final diploma to motivate them is proposed. Finally, collaboration with some institutions like the Ministry of Education, to create a pilot program to implement PBL on a large scale in educational institution of all levels, is another suggestion.

Conclusion

The main objective of this research was to develop a strategic analysis of the PBL methodology, using the SWOT analysis, which is

divided into internal (strengths and weaknesses) and external (opportunities and threats).

Starting with the internal analysis and concerning strengths, individual competences development was the most positive outcome referred, followed by social competences development, summing 66% of all references. Reality-based and meaningful experience, putting students as the centre of the learning process and pedagogical relationship improvement were also pointed out, accounting for 24% of the responses. Regarding the weaknesses: time requirement, difficult to implement, monitorization and evaluation, and the size of the class were the most stated.

Relating to the external analysis, PBL presents opportunities for both teachers and students. It is evaluated as an inspiring, adaptable (for different disciplines), developable and alternative method for teaching by the participant teachers who applied it. This method provides teacher more space to focus on pedagogical aspects during courses. Also, it enables distance learning, especially in obligatory circumstances like lock~~ed~~-downs. The most appreciated features of PBL are increasing student motivation and involvement by sharing course responsibilities. Facing with the complexity of practice and the challenges of working with others; they develop untold/new and contemporary competences, sometimes by feeling forced to use innovative thinking and creativity, and to reflect themselves on the final product. Requiring using ICT (Information Communication Tools), PBL can be called a chance for socialisation. The method promotes students for self and lifelong learning by letting them to build their own way of learning and conclusion. Additionally, by inquiring/searching, managing/using sources, coping with technologic problems and making their own evaluations; students transform the information given to the trained knowledge.

Concerning threats, some fear that PBL faces some opposition, due to the traditional approach to education, which is still teacher centred. Weak formative vs. summative assessment that teacher seem to prefer, is another obstacle. The lack of preparation of the students and the group dynamics needed is also a difficulty to successfully implementing PBL methodology.

Making a balance, one can conclude that strengths of the PBL methodology by far outcome weaknesses (59 vs. 32), inferring that this is a very valued methodology. Based on this strategic analysis results, the main conclusion is the outstanding potential of PBL methodology,

and consequently the recommendation is undoubtedly to continue and to reinforce the use of this methodology.

Another recommendation is to use the determinant attributes found to propose a scale to evaluate PBL. To do this, it is necessary to develop further studies with a more quantitative approach, so some multivariate statistical methods could be used, and scale validation could be more reliable.

In terms of limitation, the size of the sample does not allow a high degree of generalization of the results. So, it is recommended that this analysis should be repeated in a near future. This will also allow to monitor the results of the potential improvements and changes meanwhile implemented.

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