RESEARCH ARTICLE

BON VIEW PUBLISHING

From Agile Principles to Agile Classrooms: A Structured Curriculum for Educator Upskilling

Panos Fitsilis[1,*] , Evangeli Boti[1] and Vyron Damasiotis[2]

[1] Department of Business Administration, University of Thessaly, Greece

[2] Department of Accounting and Finance, University of Thessaly, Greece

Abstract: This research proposes a curriculum designed to promote the application of agile methodologies in classrooms. It identifies the key skills secondary school teachers need and categorizes them into three main areas: understanding the foundational concepts of agile methodologies, developing essential soft skills such as communication and teamwork, and enhancing digital proficiency. Guided by Gagné's instructional design model, these competencies were systematically integrated into a well-structured curriculum with clearly defined modules and units. By focusing on these three areas – agile methodologies, transversal skills, and digital competences – the curriculum aims to help teachers embrace and apply agile principles in practical, meaningful ways. It supports teachers in actively integrating agile practices into their classrooms and equips them with tools to create dynamic, collaborative learning environments where students can develop important 21st-century skills, such as adaptability and problem-solving. By empowering teachers with these skills, the curriculum establishes a pathway to transform education, making it more responsive, student-centered, and prepared for the future. It bridges the gap between traditional teaching methods and the agile practices required in today's rapidly evolving world, ensuring a smoother transition toward innovative and effective educational practices.

Keywords: agile methodologies, agile education, transversal competences, digital competences, educational curriculum, teacher training

1. Introduction

In today's rapidly evolving world, marked by continuous technological progress and the extensive impacts of globalization, people are facing a growing array of complex and often unpredictable challenges. These challenges span social, economic, environmental, and other domains[1]. These challenges, on the one hand, present opportunities for progress and, on the other hand, introduce significant obstacles that individuals and communities need to manage [1]. This trend is expected to continue in the near future, highlighting the necessity for people, particularly the youth, to develop a broad range of skills that will enable them not only to cope but also to excel in this dynamic environment.

Education is considered a key point in meeting these demands. However, traditional educational modes focusing on the transfer of knowledge have started showing their limitations, indicating that a new educational approach that cultivates a broader spectrum of skills beneficial to students in their personal, professional, and civic lives should be embraced. In this context, the integration of agile methodologies into education is gaining traction as a contemporary

and innovative approach, introducing the notion of agile education. Although there is no universally accepted definition of agile education, briefly, agile education is an educational approach that borrows from the world of software development, emphasizing learning in small incremental steps, in flexibility and adaptability to the learning process, and in collaboration both between learners and learners and educators. Learning in small incremental steps allows someone to learn and apply new knowledge quickly, while flexibility and adaptability allow learning to be adapted quickly in a continuously changing environment or be adjusted according to specific needs. These aspects of agile education offer a fresh pedagogical perspective that facilitates the development of essential skills such as effective communication, collaborative teamwork, critical thinking, and creative problem-solving, which are in line with contemporary competency requirements for individuals and extend beyond the mere imparting of information [2–4].

Prominent among the initiatives aimed at infusing agile principles into modern education are EduScrum [5], Scrum@School [6], and Agile Educator Guide [7], each one representing a unique effort to harness the potential of agile methods within the educational system.

Several studies in the literature examine the use and effectiveness of the agile approach in education [8–13]. These studies highlight the benefits of the agile approach in fostering a wide range of competencies. This research states that the successful adoption of an agile approach in education necessitates a transformative role for educators, who must be equipped with the necessary knowledge and

*Corresponding author: Panos Fitsilis, Department of Business Administration, University of Thessaly, Greece. Email: fitsilis@uth.gr

skills to effectively apply agile methodologies and achieve desired outcomes in the classroom.

Under that prism, the focus of this research lies in an in-depth exploration of the competences an educator required to have in order to efficiently apply the contemporary agile educational framework and proposes a comprehensive curriculum tailored to the needs of educators, which equips them with (a) a nuanced understanding of the principles and methodologies underpinning agile education and (b) with necessary competences required to effectively apply it. This, in turn, will empower educators to seamlessly integrate these innovative approaches into their teaching practices.

The structure of this article is as follows: Section 2 offers a comprehensive review of the competencies deemed essential for thriving in modern society. Additionally, it delves into various approaches to agile methodology in education, as well as other educational methodologies that share similar objectives. Section 3 provides a detailed exposition of the research methodology employed in this study. Moving forward, Section 4 presents an in-depth analysis of the curriculum's structure and design, offering insights into its development. Finally, Section 5 encompasses the conclusion, summarizing key findings, and outlines potential avenues for future research in this vital and evolving field of education.

2. Literature Review

The literature review highlights how an agile educational approach contributes to the development and refinement of essential competences required by contemporary individuals in modern working environments both for vocational and conventional education. Through this examination, a clear link between agile educational strategies and their role in fostering the competencies needed for success in the 21st-century workforce is established.

2.1. Agile methodologies in education

Agile methodologies in education are a student-centered approach to teaching and learning that is inspired by the principles of agile software development. Initially developed to improve the efficiency and quality of software development, agile methodologies have been adapted to other domains, including education, where they can be used to create more engaging and effective learning experiences.

Agile education emphasizes collaboration, self-direction, incremental progress, and iteration. Implementing the agile approach in education gives learners the responsibility of organizing their own task division, planning, and approach [6]. In an agile learning environment, student teams are responsible for setting their own goals, reflecting on their progress, promoting innovation and experimentation, and adapting their work plans based on team dynamics and progress [14]. It is important to highlight that agile methodologies are fundamentally interdisciplinary and require, within the agile team, the integration of transversal skills (such as communication, collaboration, and critical thinking) as well as digital competences for being effective. Similarly, in educational environments, teamworking depends on effective communication, problem-solving, and adaptability. Digital platforms are used to facilitate collaboration, transparency, and feedback cycles, which are core elements of agile practice.

Agile methodologies can be applied in several ways within the classroom, including project-based learning, problem-based learning, inquiry-based learning, or as an alternative approach to meeting curriculum requirements [7].

Wong and Li [15] explore factors like leadership, infrastructure, culture, faculty training, and student readiness that are needed for implementing agile-blended learning effectively, and they deliver a practical framework, bridging Agile theory and educational practice.

In the same line, several agile models have been introduced during the last years [16], such as the "Agile Manifesto for Higher Education" [17], the "Agile Pedagogy Manifesto" [18], the "Agile Manifesto for Teaching and Learning" [19], and the "Manifesto for Agile education"[2].

"Agile Manifesto for Teaching and Learning" [19] is the result of a two years' work by a group of faculty members who applied agile methodologies in their everyday teaching in higher education. They found that their adaptations of agile to higher education produced positive outcomes by increasing student engagement, encouraging students to take responsibility for their learning, enhancing the level and quality of collaboration, and producing higher quality deliverables.

"Agile Manifesto for Higher Education" [17] discusses how lean and agile practices can be applied to higher education to reduce waste and improve efficiency. It reflects current trends in higher education and proposes an Agile Manifesto for Education, similar to the Agile Manifesto in software development. It suggests that the quality and productivity in the education sector could be improved by adopting agile principles, aided by information and communication technology, indicating a novel approach to integrating modern management techniques into educational settings.

The "Agile Pedagogy Manifesto" [18] presents an educational approach inspired by agile methodologies, especially the scrum method used in project-based work. It explores the adaptation of this agile technique to both teaching and learning within formal education and project-based learning environments. By developing an agile pedagogical model, it aims to achieve increased autonomy for teachers and students, strategic integration of digital tools in educational practices, and the enhancement of human skills and capabilities through revised learning designs. Additionally, the Agile Pedagogy Manifesto proposes viewing the teacher–student interaction as a "technology for learning," defining technology as a deliberate process of knowledge creation.

Overall, agile methodologies in education are designed to enhance the learning experience by enabling students to take an active role in their learning and to collaborate with their peers and teachers [20]. They promote a culture of continuous improvement and innovation, which is essential for preparing students for the rapidly changing demands of the modern workplace. Encourage the adoption of information technology for enhancing their results. Below are briefly presented the most well-known agile educational frameworks.

2.2. EduScrum

EduScrum [5] is an educational framework aiming to help students tackle complex, adaptive problems while achieving learning goals and personal growth [21]. Its main advantages are that it is lightweight and easy to understand. However, it is

---

[2]Scrum at the school, "Manifesto for Agile education," 2018, https://scrumatschool.nl/wp-content/uploads/2018/11/Manifesto-for-Agile-Education.pdf

challenging to master as student teams need to do that by themselves. EduScrum focuses on the "What," meaning the objectives and goals, while leaving the "How," the methods and processes, up to the student teams. EduScrum does not provide any specific strategy but allows various strategies to be applied during the educational process. It emphasizes transparency and the effectiveness of the chosen plans and approaches, enabling students to self-assess and improve their performance. EduScrum fosters self-organization teams, sets clear learning objectives, and requires high-quality work to be done within specific time limits. This approach encourages continuous evolution in the quality of work, collaboration, and personal development throughout the school year.

A key aspect of EduScrum is the concept of ownership, where students have a significant say in defining their work quality. This, combined with the framework's emphasis on continuous improvement, leads to enhanced overall quality. EduScrum includes review and retrospective processes for identifying good or bad practices and fostering continuous improvement and fault avoidance.

Consequently, EduScrum offers an innovative approach to learning, where students are actively involved in their educational journey, leading to deeper engagement and more effective learning outcomes.

2.3. Scrum@School

Scrum@school [6] is an educational framework that transforms the traditional classroom environment by promoting student responsibility, a growth mindset, teamwork, continuous feedback, and adaptability. It is designed to encourage students to take ownership of their learning, self-organize, and collaborate in teams, enhancing their motivation and engagement. Specifically:

1) Responsibility and Ownership: Students are encouraged to work independently and collaboratively, taking responsibility for their learning process. Scrum@school provides a structure and an overview through tools like the Scrum board, fostering a sense of ownership and self-regulation.
2) Kaizen Mindset: Emphasizing continuous improvement, Scrum@school adopts the Kaizen philosophy of making small, incremental improvements. This mindset prioritizes ongoing learning and growth over merely meeting standards.
3) Teamwork: The framework supports team learning and acknowledges the importance of teamwork in cognitive, personal, and social development. It emphasizes that teamworking enhances learning and leads to better outcomes than individual efforts.
4) Feedback Over Grades: Scrum@school incorporates continuous feedback loops instead of focusing solely on grades. This approach facilitates formative assessment, allowing students to reflect on and improve their work and methodologies continually.
5) Adaptability and Agile Practices: It encourages a flexible approach to learning, where students and teachers are adaptable and responsive to changes. This adaptability ensures that learning strategies and project plans remain relevant and effective.

In summary, Scrum@school places equal emphasis not only on the subjects being taught but also on the learning process followed. It concentrates not just on the outcomes but also provides equal value to the processes leading to those results. Beyond individual achievements, it prioritizes the performance of the entire team and its members. In that way, it is redefining the learning environment to make it more student-centered, collaborative, and responsive, enhancing both the learning experience and outcomes.

2.4. The Agile Educator Guide

Vizdos in 2021 introduced "The Agile Educator Guide" [7], which is an agile framework for modern education. The primary goal of this framework is to better prepare students for the challenges of the 21st century. It involves fostering skills and mindsets in students that are adaptable, dynamic, and suitable for a fast-paced and uncertain world.

The framework critiques the existing education system approach, which is characterized by unidirectional information flow, strict adherence to rigid curricula, set deadlines, and teacher-defined assessments. Instead, it promotes an educational approach where students have more agency in their learning process. This includes the abilities for self-direction and effective collaboration.

Agility in the classroom, according to this framework, can be in various forms such as individual projects, project or problem-based learning, inquiry-based learning, or as a means for students to achieve content standards that are aligned with the curriculum. The overall aim is to create an education system that is more responsive and relevant to the needs of contemporary students who will face complex problems in their future lives and careers.

2.5. Innovative educational models that can support agile approach

As mentioned in Section 2.1, it incorporates the use of other innovative educational models that can support the implementation of agile education methodologies by promoting engagement, efficiency, and practical learning. These approaches complement agile's focus on iterative processes, collaboration, and continuous improvement, fostering a dynamic and responsive educational environment [22]. Below are briefly presented the most well-known of them.

2.5.1. Project-based learning

Project-based learning (PBL) is a teaching approach in which students engage in extended, interdisciplinary projects that allow them to explore real-world problems and challenges [23]. This approach emphasizes student-centered learning and collaboration, as students work in teams to develop solutions to authentic problems [9, 24].

PBL is widely used in many educational settings, from elementary schools to universities, and has been shown to have numerous benefits for students, including improved critical thinking skills, increased engagement, and better retention of information [11]. Some key features of PBL include [25]:

1) A focus on real-world problems or challenges
2) Student-centered learning, with students taking an active role in their own education.
3) Collaborative work, with students working in teams to develop solutions to problems.
4) Integration of multiple disciplines, with projects often involving elements of math, science, language arts, and other subjects
5) An emphasis on inquiry-based learning, where students ask questions and conduct research to solve problems.

Overall, PBL is a powerful approach to teaching and learning that can help students develop critical skills while engaging with real-world problems and challenges.

2.5.2. Lean education

Lean thinking is an approach that aims to increase process productivity by eliminating non-value-added items. While initially used in the industrial sector, it has since been applied to other disciplines with excellent results. Some of the basic concepts of lean thinking include defining value from the standpoint of the end customer, eliminating all waste in all processes, continuously improving all educational processes, and defining a continuous workflow based on Kanban boards [26].

One of the fundamental principles of lean thinking is the elimination of waste, which can come in eight different forms: overproduction, inventory, overprocessing, defects, transportation, motion, waiting, and unused creativity [27].

Within the educational context, lean functions as an organizational development program aimed at enhancing both performance and job satisfaction for everyone involved in the education system. This approach enhances processes by identifying and eliminating unnecessary or obstructive stages and streamlining work completion. Schools that adopt lean are more adept at delivering their activities and services, as they focus on maximizing the learning abilities of all students and fostering an environment conducive to success and satisfaction through a comprehensive systemic approach. Under lean education, learning groups, comprising both students and teachers, engage collaboratively as equals. They jointly make decisions and address classroom challenges, learning from each other. Challenges encountered during decision-making are not viewed as barriers to achieving objectives but as catalysts for sparking new ideas and innovations. Key principles of the lean method include transparency, collaboration, efficiency, and joint learning.

Extensive studies and experiments have explored the application of lean principles and practices to teaching, particularly in technology and other STEAM (science, technology, engineering, arts, and mathematics) disciplines, yielding promising results[3]. Although many higher education institutions have integrated these principles into their administrative and institutional functions, the application of lean thinking to the teaching and learning process has remained uncharted or intentionally overlooked. Consequently, its utilization in the realm of education is still regarded as innovative and remains unknown.

2.5.3. Flipped classroom

The flipped classroom is a teaching approach in which the traditional in-class lectures and homework assignments are reversed. In a flipped classroom, students watch pre-recorded lectures or read material before coming to class [28]. During the class, they engage in activities such as discussions, problem-solving, and project-based learning under the guidance of the teacher [29].

The main objective of the flipped classroom is to shift the focus from passive learning to active learning, peer, and problem-based learning. Students are encouraged to take responsibility for their own learning and collaborate with their peers [29]. The flipped classroom approach has been shown to improve student engagement, participation, and performance in numerous studies [28].

The flipped classroom can be implemented in different ways depending on the needs of the students and the subject matter. There are various tools and resources available to facilitate the creation and sharing of pre-recorded lectures and other learning materials, such as videos, podcasts, and online quizzes.

2.5.4. Inquiry learning

Inquiry-based learning is an educational approach that places the student at the center of the learning process. It is a student-centered approach to learning where students ask questions, make observations, investigate, and draw conclusions [30]. Rather than simply memorizing facts and information, inquiry-based learning encourages students to actively engage with the material they are studying and apply it to real-world problems.

Inquiry-based learning has many different forms, and it is used in a variety of subjects and settings. Some of the key features of inquiry-based learning are:

1) It is student-led, since the focus is on students asking questions and exploring their ideas.
2) It is open-ended learning since it attempts to develop knowledge and new insights.
3) Collaborative, learners work together in groups to investigate problems and share ideas.
4) Self-directed learning, with students taking increasing responsibility for their learning.

Examples of inquiry-based learning activities include conducting experiments, research projects, case studies, debates, and simulations. It is often used in science, social studies, and language arts classes but can also be applied to other subjects.

Inquiry-based learning seeks to promote deeper learning and understanding by engaging learners in the process of exploration and discovery. It encourages them to become active learners who are motivated to seek out answers and solutions to problems. Inquiry-based learning has been found to be effective in increasing learner engagement, promoting critical thinking and problem-solving skills, and fostering a love of learning. It is used in a variety of educational settings, from early childhood education to higher education.

2.6. Comparison of educational approaches

A comparison table highlights the key features and differences among the learning methodologies that follow: lean education, project-based learning, flipped classroom, inquiry-based learning, and agile learning.

Please note that this table provides a general overview, and there can be variations in the implementation of these methodologies based on specific educational contexts and goals.

3. Research Methodology

3.1. Research design

The aim of this research is twofold: initially, to identify a set of competences that educators need to obtain or improve to be able to better implement agile practices in the educational process and, second, to propose an educational curriculum that implements the previous aim. To achieve this aim, the following steps were followed:

## 3.2. Sampling and data collection procedure: Needs analysis

In order to identify the needs, a survey was conducted among primary and secondary school teachers in three countries: Greece, Germany, and the Czech Republic. The survey aimed to identify the level of awareness about agile methodologies among schoolteachers and gather their opinions about the effectiveness of these methodologies and what competence they would like to upskill in applying

---

[3]UNESCO International Bureau of Education, "Glossary of curriculum terminology", 2013, https://unesdoc.unesco.org/ark:/48223/pf0000223059

Table 1
Comparison of educational approaches

Methodology	Core principles	Approach	Focus areas	Benefits
Lean education	Eliminate waste, continuous improvement, value creation	Streamline processes, focus on customer value	Process efficiency, educational waste reduction	Enhanced efficiency, innovation, customer-centricity
Project-based learning	Real-world projects, collaboration, interdisciplinary	Solving authentic problems, student engagement	Real-world problems, teamwork, creativity	Critical thinking, engagement, holistic learning
Flipped classroom	Active learning, pre-class content, in-class activities	Pre-recorded content, in-class interaction	Student engagement, peer collaboration	Improved engagement, deeper understanding
Inquiry-Based learning	Student-led, open-ended, collaboration, exploration	Explore, investigate, draw conclusions	Critical thinking, problem-solving	Deep understanding, active learning, curiosity
Agile learning	Iterative, adaptable, feedback-driven, collaboration	Continuous improvement, learner-centered	Flexibility, personalized learning	Adaptability, collaboration, self-directed learning, responding to changes

Figure 1
Methodological steps
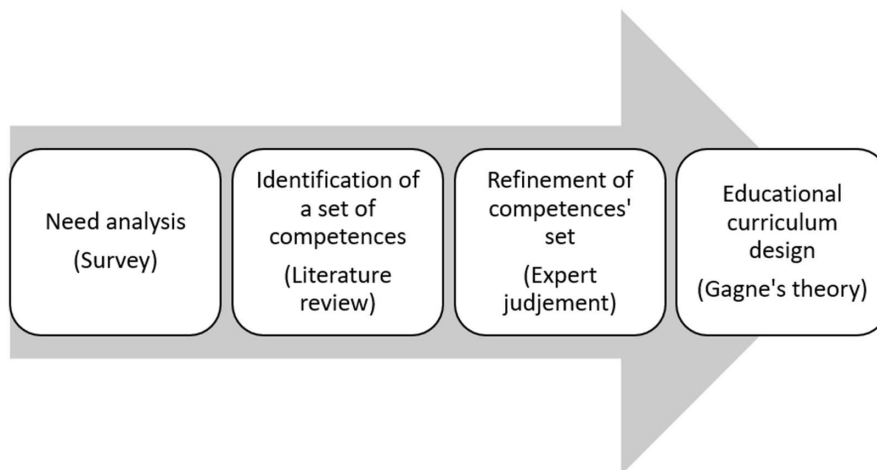
agile methodologies efficiently. The survey was conducted in April 2021. The questionnaire was developed by experts in agile methodologies who participated in the project and was reviewed by all project members. It was distributed electronically through Google Forms to schoolteachers in the three aforementioned countries.

A total of 102 responses were collected. Considering the survey demographics, 73.5% of respondents were women. In terms of age, 49% were older than 51, 47% were between 30 and 50 years old, and the remaining respondents were younger. The majority (84.3%) were based in Greece, with the rest from the Czech Republic and Germany. Regarding teaching experience, 40.2% had more than 25 years of experience, 56.9% had between 11 and 25 years, and the remainder had less than 10 years. As for their current roles, 82.3% were schoolteachers, 11.8% worked in school or education administration, and the rest held other positions within the education system (e.g., advisors and policymakers).

The survey took place during the implementation of an Erasmus+ project named Agile2Learn. More details about the project can be found on the Agile2Learn[4] website.

In summary, the survey results reveal varying levels of familiarity with the agile methodology among schoolteachers: 27.5% were unaware, 29.4% had slight awareness, 21.6% possessed moderate awareness, and 21.5% were highly or extremely aware of the methodology. However, most teachers acknowledge the advantages of agile methodologies in the educational process. Specifically, 68.9% believe that agile methods can enhance interaction among school stakeholders, 55.9% see potential for improved collaboration among educators, and 46.1% envision benefits for overall school administration.

Finally, the survey indicated that the development of a curriculum focusing on agile methodologies in education should be grounded in three competences pillars: one related to the theoretical foundations of agile methodologies, one devoted to the development of transversal competences, and one supporting the development of competences related to digital transformation. These findings provided a solid foundation to continue this research.

3.3. Data analysis: Identification of competences

The next task was to identify which competences are necessary to be developed by teachers to effectively apply the agile methodologies. The results of the survey were an initial indicator, but further,

_____
[4]Agile2Learn, "https://agile2learn.eu/"

a literature review was conducted to identify the necessary competences in the literature, as the application of agile methodologies requires not only theoretical knowledge of methodology but also a broader set of competencies.

The literature review focused on various competence frameworks that were developed by various national and/or international organizations such as the EU, UNESCO, etc., to identify the several types of competences needed as must have for the next decades.

For digital competences, the following key frameworks were examined: the Digital Competence Framework for Educators, known as DigiCompEdu; the Digital Competence Framework for Citizens, referred to as DigiComp2.2 [31]; and the Pedagogical Guide of Digital Competency Framework[5]. The latter also contributed to the identification of some transversal competences. Additional sources for identifying transversal competences included the insights derived from the EU conference titled *Supporting Key Competence Development: Learning Approaches and Environments in School Education* [32]; the Key Competences for Lifelong Learning framework in European Schools [33]; LifeComp: The European Framework for Personal, Social, and Learning to Learn Key Competence [34]; the Guide for Fostering Entrepreneurship Education [35]; and the 2BDigital project[6].

To identify agile competences, primary references were used, including Scrum [36] and Kanban [37] agile methodologies, complemented by insights from various agile educational frameworks such as the Manifesto for Agile Education[2], the EduScrum Guide [5], and the Scrum@School Guide [6]. These references collectively provided the foundation for the identification of agile competences.

3.4. Validity and reliability check: Refinement of competences

The set of competences identified in the previous step was refined by a group of experts to check its suitability, completeness, and correctness. The expert group consisted of twelve academics and professionals with deep knowledge and extensive experience in agile methodologies and/or educational domains from four European countries, namely, Greece, Italy, Germany, and the Czech Republic. The experts were selected by project partners of the Erasmus+ Agile2Learn project.

3.5. Educational design

Once the final set of competences was identified, the subsequent step focused on the educational design of the curriculum. The design phase of a course holds paramount importance in preparing for its eventual implementation.

The curriculum design process began by mapping each identified competency to a corresponding module within the curriculum. Each module was composed of a series of units. Subsequently, to achieve the desired learning outcomes, one or more learning objects were designed for each unit, aligned with Gagne's instructional design theory [38]. These seven steps are:

1) All the materials should start with a brief description of the material to activate the trainees' attention.

2) The material should be connected to prior relevant content.
3) The content should be presented in alternative forms (PDF, PowerPoint, video clips, interactive materials, etc.)
4) Guidance should be provided through examples, forums, email support, external resources, and frequent synchronous sessions.
5) Practical exercises and case studies for each concept should be included.
6) Automated feedback or specific model solutions should be provided.
7) Performance should be assessed through various practical activities and quizzes.

To ensure consistency and a common structure, a set of templates dedicated to preserving the metadata associated with the modules, units, and educational materials was created. These templates played a pivotal role in guiding the systematic development and structuring of each module. The key outputs of this phase were:

1) Course structure: a detailed description of the course's structure, which fulfills the aims of the course.
2) Course module description: a detailed description of every course module and its association with specific competencies.
3) Course units (learning activities) description: a detailed description of the units per course module.
4) Learning objects: a detailed description of the learning objects per unit.
5) Learner assessment description: a detailed description of the learner assessment of the course module/unit.

They provided essential information on objectives, keywords, required workload, educational strategies, and external resources and facilitated the seamless linkage of learning objects to the intended learning outcomes. The structure of the course can be seen in Figure 2.

4. Results: Agile2Learn Curriculum

As highlighted in the initial needs analysis in step 1, Section 3, many teachers lack familiarity with agile methodologies and thus require comprehensive training to effectively apply them. Additionally, the utilization of agile methodologies demands more than just theoretical knowledge; it necessitates the acquisition of a broader set of skills and competencies, including communication, teamwork, empathy, and more.

According to these findings, a curriculum design was developed to equip teachers with the expertise required to integrate agile methodologies into their classrooms. The developed curriculum is strategically aligned with:

1) the imperative of digital transformation and technology utilization
2) the empowerment educators to develop and enhance their personal and social skills
3) the furnishing of teachers with the requisite technical knowledge concerning agile methodology artifacts, ceremonies, and functions, all of which are directly applicable in the classroom environment.

These three distinct categories of competences were named "Agile," "Transversal," and "Digital" competences and collectively constitute the educational components of the proposed curriculum, as illustrated in Figure 3.

In the context of this research and according to UNESCO UNE-VOC Glossary[3], "Transversal" competences are defined as the skills

---

[5]Ministry of Education and Higher Education, "Pedagogical Guide. Digital Competency Framework," 2020, https://www.education.gouv.qc.ca/fileadmin/site_web/documents/ministere/guide-cadre-reference-PAN-en.pdf

[6]Hazel Israel, "The 2BDIGITAL project: A collaborative framework. 2BDigital," 2022, https://2bdigitalproject.eu/wp-content/uploads/2022/06/2BDigital-Competence-Framework-Guide-EN.pdf
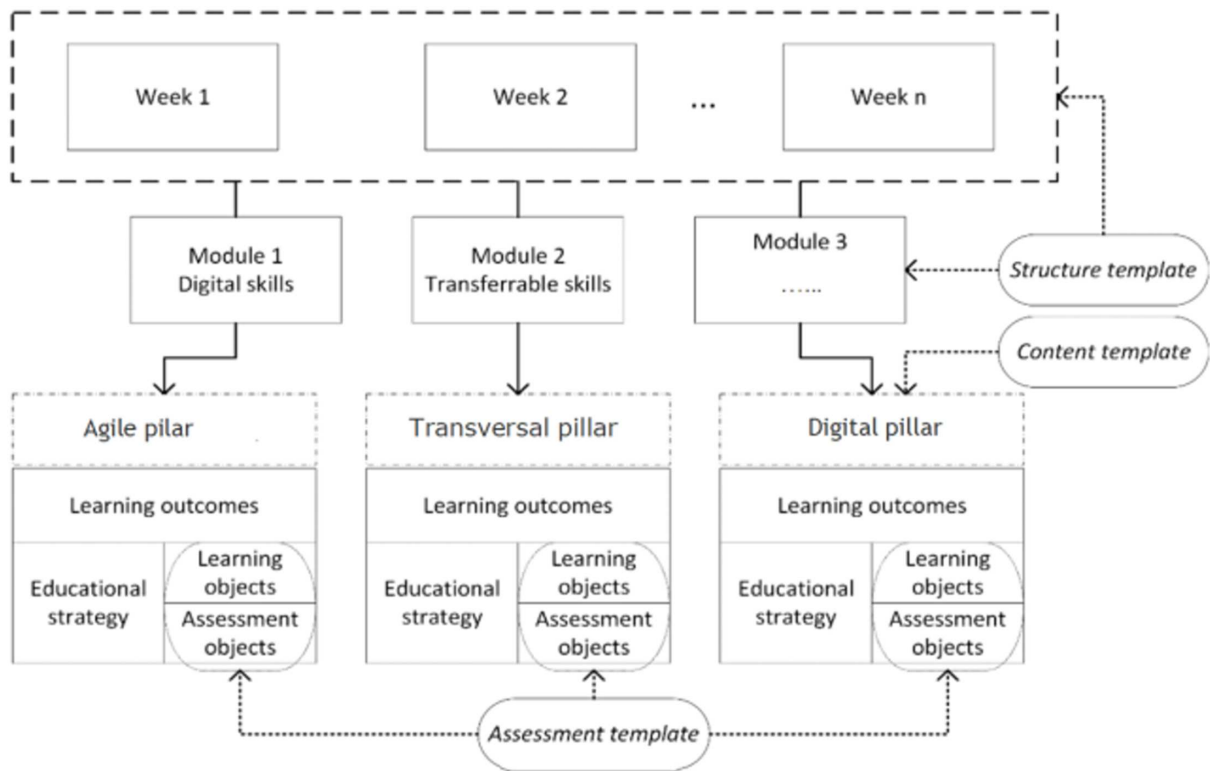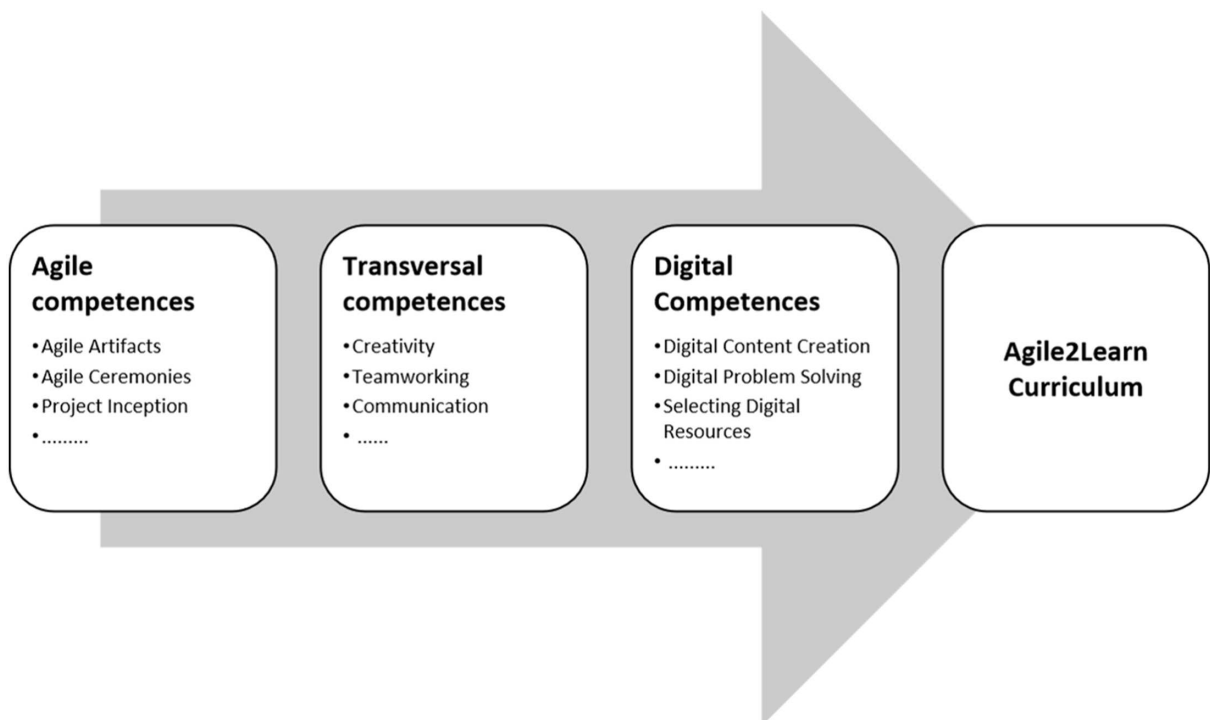
Figure 2
Course structure

Figure 3
Agile2Learn curriculum components

that are not specifically related to a particular job, task, academic discipline, or area of knowledge but can be used in a wide variety of situations and work settings. Acquiring these competencies is crucial for individuals to adjust to fluctuations and lead purposeful and fruitful lives, as they are highly sought-after in the learning process. "Digital" competences are identified as competences aiming to support educators/teachers in identifying, selecting, using, and evaluating digital tools that can assist them in the educational process, improving the learning process, and aiding in their individual development. Finally, "Agile" is defined as the competence that refers to the knowledge of agile methodologies including tools, techniques, and processes.

4.1. Competences development through the proposed curriculum

As it was already described in detail in step 2, Section 3, to identify the essential competences that this curriculum should support, various competence frameworks by organizations like the EU and UNESCO, focusing on digital and transversal competences such as DigiCompEdu and DigiComp2.2, alongside broader frameworks like LifeComp, were examined. Agile competences were also detailed, drawing on methodologies like Scrum and Kanban.

Initially, a total of twenty-five competences spanning all three components were identified. Subsequently, twelve experts originating from Greece, Italy, Germany, and the Czech Republic, representing diverse domains including academia, secondary education, adult education, and vocational education and training were engaged. After a rigorous refinement process, a final list of twenty-one competences was identified [39]. This comprehensive list is presented in Table 2.

4.2. Agile2Learn curriculum delivery structure

The curriculum delivery structure of Agile2Learn consists of two main stages: (i) the delivery of training courses (blended course) and (ii) the implementation of workplace learning. The sequence is depicted in Figure 4.

4.2.1. Stage 1: Delivery of training course (blended learning)

A total of twenty-one modules corresponding to the identified competences should be systematically delivered to learners through a blended learning approach. The proposed workload for the blended course is 40 hours, spread over 8–10 weeks. It encompasses a combination of face-to-face workshops and tutoring meetings.

Figure 4
Agile2Learn training scheme

The delivery is divided into three distinct phases (see Table 3). Each phase is designed to progressively build learners' knowledge and expertise in agile methodologies:

Introductory Phase: The initial phase provides learners with foundational knowledge of agile methodologies, offering a comprehensive understanding of the core principles and concepts underlying agile approaches.

Intermediate Phase: In the second phase, learners delve deeper into the application of agile methodologies. Specific and more advanced concepts are introduced, enabling participants to grasp the nuances and intricacies of agile practices.

Specialized Phase: The third and final phase offers specialized learning experiences in specific domains related to agile methodologies. Participants can explore advanced topics and gain in-depth expertise in their chosen areas of specialization within the agile framework.

This phased approach ensures a well-rounded and comprehensive competence delivery process, gradually guiding learners from foundational knowledge to advanced, specialized skills in the realm of agile methodologies.

4.2.2. Stage 2: Workplace learning

Upon the successful completion of the blended learning program, the subsequent phase of workplace learning is initiated, featuring the implementation of a capstone project. The proposed duration for this phase is 14–16 weeks with an average workload of 5 hours per week.

The workplace learning phase serves as a distinctive opportunity that allows them to seamlessly integrate the concepts and principles they have acquired throughout the preceding phases. It enables a profound understanding and practical application of the knowledge gained in an authentic educational context.

The benefits of using a capstone project for workplace learning are:

1) Real-World Application of Agile Techniques: The capstone project facilitates the practical application of agile methodologies in a genuine educational environment. This firsthand experience offers valuable insights into both the challenges and advantages of employing agile methodologies in the field of education [11, 40, 41].

2) Promoting Collaboration: The capstone phase encourages collaborative efforts between schoolteachers and various stakeholders within the educational ecosystem. This collaborative environment enhances the effective implementation of agile techniques, harnessing the collective expertise and diverse perspectives of all involved parties.

3) Enabling Reflective Learning: This phase provides an opportunity for schoolteachers to engage in reflective practice, enabling them to contemplate their own learning journey and assess the impact of agile techniques on the educational outcomes of their students. Such introspection often leads to enhancements in teaching methodologies and informs future applications of agile methodologies in education.

4) Enhancing Employability: The successful completion of the capstone project serves as tangible evidence of schoolteachers' proficiency in applying agile educational methodologies. This evidence can significantly augment their employability prospects, effectively highlighting their practical expertise in the realm of agile education.

5) Fostering Innovation and Creativity: The capstone project acts as a catalyst for innovation and creativity in teaching practices. School teachers are encouraged to explore novel and
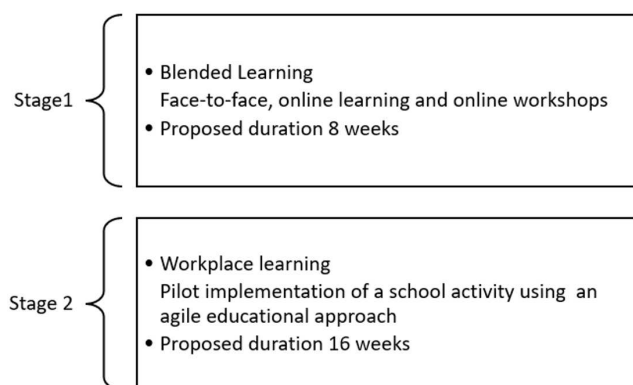
Table 2
Curriculum supported competences.

Competence category	Knowledge/skill	Description
Agile competences	Agile methods fundamentals	Scrum, Kanban, Lean Management, XP
	Entrepreneurial thinking	The ability to identify market opportunities and capitalize on them, individually or collaboratively, with a sense of agency, forward-thinking, and courage.
	Project inception (planning)	Planning project completion within a specified timeframe, involving defining roles, facilitating communication, setting objectives, scheduling, and more.
	Self-managed teams	Formation of groups utilizing diverse skills, knowledge, and experience to achieve common goals, taking full responsibility through peer collaboration.
	Agile artifacts	Information used by stakeholders and the scrum team to describe the product under development, including elements like product backlog and scrum backlog.
	Agile ceremonies	A set of prescribed events or rituals within agile methodologies, promoting collaboration, transparency, and adaptability, e.g., Sprint, Sprint Review.
Transversal competences	Communication	Understanding communication codes, rules, techniques, and barriers in different environments and situations.
	Creativity	Generating original and valuable ideas or solutions that are innovative and meaningful.
	Teamworking	Collaborative efforts of a group to achieve common goals efficiently, considering individual strengths and diverse perspectives.
	Social skills	Abilities and behaviors enabling effective and appropriate interactions with others in various social situations, including communication, collaboration, empathy, and conflict resolution.
	Handling ambiguity	Dealing sensibly and systematically with ambiguous situations, particularly in risk management and decision-making, even when information is partial or uncertain.
	Critical thinking	Objectively analyzing and evaluating information to form well-reasoned judgments or decisions.
	Problem-solving and decision-making	Identifying, analyzing, and resolving problems systematically and efficiently using logical, creative, and critical thinking. Includes skills like active listening, analysis, creativity, communication, dependability, and team building.
	Time management	Productively and efficiently using time by prioritizing and scheduling tasks to achieve goals.
Digital competences	Digital collaboration at professional and learning levels	Utilizing digital technologies for effective collaboration.
	Selecting digital resources	Identifying, evaluating, and selecting digital resources for teaching and learning, considering learning objectives, context, pedagogical approaches, and learner profiles.
	Creating and modifying digital resources	Adapting and building upon openly licensed and other digital resources (where permitted). Creating or co-creating new digital educational materials, with consideration for learning objectives, context, pedagogical approaches, and learner profiles.
	Managing, protecting, and sharing digital resources	Organizing digital content for accessibility by learners, parents, and educators. Ensuring effective protection of sensitive digital content. Adhering to privacy and copyright regulations. Understanding and applying open licenses and open educational resources, including proper attribution.
	Actively engaging learners	Using digital technologies to enhance learners' active and creative engagement with subject matter. Integrating digital technologies into pedagogical strategies promotes transversal skills, critical thinking, and creative expression.
	Digital content creation	Incorporating learning activities, assignments, and assessments that require learners to express themselves digitally. Modifying and creating digital content in various formats. Teaching learners how copyright and licensing relate to digital content, source referencing, and license attribution.
	Digital problem-solving	Incorporating learning activities, assignments, and assessments that challenge learners to identify and resolve technical issues or apply technological knowledge in innovative ways to new situations.

Table 3
Blended learning phases with relative modules

Phase 1 (Introductory)	Phase 2 (Specific to agile learning)	Phase 3 (Specialized knowledge)
Digital		
1) Creating and modifying digital resources	1) Digital collaboration at professional and learning levels	1) Digital problem-solving
2) Selecting digital resources	2) Actively engaging learners	2) Digital content creation
		3) Managing protecting and sharing digital resources
Agile		
1) Agile fundamentals	1) Project inception	
	2) Self-managed teams	
	3) Agile artifacts	
	4) Agile ceremonies	
Transversal		
1) Communication	1) Time management	1) Entrepreneurial thinking
2) Teamworking		2) Social skills
3) Problem-solving and		3) Handling ambiguity
4) Decision-making		
5) Creativity		
6) Critical thinking		

effective methods of implementing agile techniques in education, contributing to improved educational outcomes for their students.

Within the curriculum developed for this program, exemplary capstone projects are provided as illustrative models. These projects can be readily adopted by schoolteachers either in their entirety or as guiding templates to inspire the creation of their own distinctive projects. This resource not only facilitates the practical application of agile methodologies but also nurtures educators' innovative and impactful teaching endeavors.

5. Conclusion, Limitations, and Future Work

In the contemporary educational landscape, educators face the constant need to adapt to evolving techniques, tools, and teaching methodologies. Embracing these changes can be challenging, and various strategies have been proposed to facilitate this process, with agile methodologies emerging as a particularly promising avenue. The primary objective of this research is to design an educational curriculum tailored to empower secondary school teachers with the competences required to proficiently apply agile methodologies within a classroom setting.

To accomplish this goal, an extensive investigation was conducted into various agile education frameworks to pinpoint the essential components that an agile educational curriculum should encompass. Additionally, comprehensive research was carried out on educational guidelines issued by esteemed international organizations like OECG and the European Commission, along with a thorough review of pertinent literature. This multifaceted approach enabled the identification of key competences that a modern curriculum should encompass.

The outcome of this research is the development of a curriculum that prioritizes the cultivation of three distinct types of competences: agile, transversal, and digital, totaling twenty-one competences. Furthermore, the curriculum's effective delivery methods are meticulously detailed to maximize its efficiency in fostering teacher development. A key limitation of this study is that it concludes at the curriculum development stage and does not include empirical implementation or evaluation; thus, the actual effectiveness

of the proposed agile-based curriculum in enhancing teaching practices and educational outcomes remains to be validated in future research.

It is worth noting that this work is an ongoing endeavor, and there may be specific details that require further refinement. The proposed curriculum will undergo rigorous testing and evaluation through its application to a group of secondary school teachers drawn from four European countries as part of the EU Erasmus+ Agile2Learn project. The outcomes of the curriculum piloting phase will serve as valuable feedback, potentially pinpointing areas in need of improvement. Addressing these areas of improvement will culminate in the final version of the curriculum, thereby ensuring its utmost efficacy and relevance in enhancing the competences of secondary school teachers in the realm of agile methodologies. Future research should focus on empirically implementing and evaluating the proposed curriculum in real classroom settings, with particular attention to the practical challenges and enabling factors teachers may encounter during adoption. Another important direction would be to examine how advancements in digital technologies, especially emerging technologies such as generative artificial intelligence (AI), can further support and enhance agile-based teaching.

Funding Support

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support this work are available upon reasonable request to the corresponding author.

Author Contribution Statement

Panos Fitsilis: Conceptualization, Verification, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition. **Evangeli Boti:** Validation, Resources, Writing – original draft, Writing – review & editing. **Vyron Damasiotis:** Methodology, Validation, Writing – original draft, Writing – review & editing, Visualization, Project administration.

References

[1] Al-Sholi, H. Y., Shadid, O. R., Alshare, K. A., & Lane, M. (2021). An agile educational framework: A response for the covid-19 pandemic. *Cogent Education*, *8*(1), 1980939. https://doi.org/10.1080/2331186X.2021.1980939

[2] Boti, E., Damasiotis, V., & Fitsilis, P. (2021). Skills development through agile capstone projects. In *Frontiers in Software Engineering: First International Conference*, 97–112. https://doi.org/10.1007/978-3-030-93135-3_7

[3] Venkatraman, S., Benli, F., Wei, Y., & Wahr, F. (2022). Smart classroom teaching strategy to enhance higher order thinking skills (HOTS)—An agile approach for education 4.0. *Future Internet*, *14*(9), 255. https://doi.org/10.3390/fi14090255

[4] Li, K. C., & Wong, B. T. M. (2025). Pedagogical framework for technology-mediated agile-blended learning. *SN Computer Science*, *6*(3), 253. https://doi.org/10.1007/s42979-025-03774-z

[5] EduScrum. (2020). *The eduScrum Guide. "The rules of the Game."* Retrieved from: https://art2beagile.slab.com/posts/edu-scrum-guides-fk6r8ill

[6] Reehorst, E., van Rossum, J., & Saris, S. (2019). *Scrum@school Guide. Scrumatschool*. Retrieved from: https://scrumatschool.nl/wp-content/uploads/2019/03/Guide-EN-2019.pdf

[7] Vizdos, M. (2021). *The agile educator guide. An agile framework for modern education*. Retrieved from: https://www.michaelvizdos.com/agile-educator-guide

[8] Arce, E., Suárez-García, A., López-Vázquez, J. A., & Fernández-Ibáñez, M. I. (2022). Design sprint: Enhancing STEAM and engineering education through agile prototyping and testing ideas. *Thinking Skills and Creativity*, *44*, 101039. https://doi.org/10.1016/j.tsc.2022.101039

[9] Chueh, H. E., & Kao, C. Y. (2024). Exploring the impact of integrating problem based learning and agile in the classroom on enhancing professional competence. *Heliyon*, *10*(3), e24887. https://doi.org/10.1016/j.heliyon.2024.e24887

[10] Confrey, J., Maloney, A. P., Belcher, M., McGowan, W., Hennessey, M., & Shah, M. (2018). The concept of an agile curriculum as applied to a middle school mathematics digital learning system (DLS). *International Journal of Educational Research*, *92*, 158–172. https://doi.org/10.1016/j.ijer.2018.09.017

[11] Marnewick, C. (2023). Student experiences of project-based learning in agile project management education. *Project Leadership and Society*, *4*, 100096. https://doi.org/10.1016/j.plas.2023.100096

[12] Riedl, W., Brown, A., & Rausenberger, J. (2024). An "Agile" project planning course: Learning by doing in process engineering education. *Education for Chemical Engineers*, *48*, 15–21. https://doi.org/10.1016/j.ece.2024.04.003

[13] Sharp, J. H., Mitchell, A. J., & Lang, G. (2020). Agile teaching and learning in information systems education: An analysis and categorization of literature. *Journal of Information Systems Education*, *31*(4), 269–281.

[14] Urueña, R. C., Aránega, A. Y., & Núñez, M. T. D. V. (2023). Approach to the working environment through the implementation of agile methodology for effective team management in a university context. *ESIC Market*, *54*(2), e331–e331. https://doi.org/10.7200/esicm.54.331

[15] Wong, J. M. S., & Li, K. C. (2025). Technology-enabled institutional readiness for agile-blended learning: A framework for educational innovation. *SN Computer Science*, *6*(3), 279.

[16] Dhir, S., Kumari, S., & Gupta, S. (2024). Agile approaches and practices in higher education systems. In M. Bhatia & M. T. Mushtaq (Eds.), *Enhancing education with intelligent systems and data-driven instruction* (pp. 1–22). IGI Global. https://doi.org/10.4018/979-8-3693-2169-0.ch001

[17] Kamat, V. (2012). Agile Manifesto in higher education. In *IEEE Fourth International Conference on Technology for Education, Hyderabad*, 231–232. https://doi: 10.1109/T4E.2012.49.

[18] Royle, K., & Nikolic, J. (2016). Agile work practices for learning and teaching: What we can learn from agile work practices about learning and teaching in schools. *Journal of Information Systems Education*, *31*(4), 1–32.

[19] Krehbiel, T. C., Salzarulo, P. A., Cosmah, M. L., Forren, J., Gannod, G., Havelka, D., ... & Merhout, J. (2017). Agile Manifesto for teaching and learning. *Journal of Effective Teaching*, *17*(2), 90–111.

[20] Bergaoui, N., & Ghannouchi, S. A. (2023). A BPM-based approach for ensuring an agile and adaptive learning process. *Smart Learning Environments*, *10*(1), 40. https://doi.org/10.1186/s40561-023-00259-5

[21] Schuhbauer, H., Brockmann, P., & Schötteler, S. (2024). Agile learning: Use of eduScrum in higher education. *Education and New Developments*, *2*, 162–166. https://doi.org/10.36315/2024v2end034

[22] Sadullayev, I. (2025). The role of innovative methodologies in the implementing the electronic educational system: Agile, Scrum, and eduScrum. In *AIP Conference Proceedings*, AIP Publishing. https://doi.org/10.1063/5.0257195

[23] Almulla, M. A. (2020). The effectiveness of the project-based learning (PBL) approach as a way to engage students in learning. *SAGE Open*, *10*(3), 1–15. https://doi.org/10.1177/2158244020938702

[24] Palová, A., & Králová, E. (2023). Transformative education with agile project management and project-based learning. *Ad Alta: Journal of Interdisciplinary Research*, *13*(2), 197–206. https://doi.org/10.33543/j.1302.197206

[25] Markula, A., & Aksela, M. (2022). The key characteristics of project-based learning: How teachers implement projects in K-12 science education. *Disciplinary and Interdisciplinary Science Education Research*, *4*(1), 2. https://doi.org/10.1186/s43031-021-00042-x

[26] Parsons, D., & MacCallum, K. (2018). Agile education, lean learning. In D. Parsons & K. MacCallum (Eds.), *Agile and lean concepts for teaching and learning: Bringing methodologies from industry to the classroom* (pp. 3–23). Springer. https://doi.org/10.1007/978-981-13-2751-3_1

[27] Martínez Sanahuja, S. (2020). Towards lean teaching: Non-value-added issues in education. *Education Sciences*, *10*(6), 160. https://doi.org/10.3390/educsci10060160

[28] Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day* (pp. 120–190). USA International Society for Technology in Education.

[29] Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In *ASEE National Conference Proceedings*, 1–18.

[30] Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T., . . . , & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61. https://doi.org/10.1016/j.edurev.2015.02.003

[31] Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The digital competence framework for citizens – With new examples of knowledge, skills and attitudes*. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/115376, JRC128415

[32] O'Shea, M., & Frohlich Hougaard, K. (2020). *Supporting key competence development: Learning approaches and environments in school education: input paper*. Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2766/8227

[33] European Commission. (2019). *Key competences for lifelong learning*. Luxembourg: European Commission Publications Office. https://data.europa.eu/doi/10.2766/569540

[34] Sala, A., Punie, Y., Garkov, V., & Cabrera Giraldez, M. (2020). *LifeComp: The European framework for personal, social and learning to learn key competence*. Luxembourg: Publications Office of the European Union. https://doi:10.2760/302967, JRC120911

[35] Lilischkis, S., Tømmerbakke, J., Melleri, M., Volkmann, C., & Grünhagen, M. (2021). *A guide to fostering entrepreneurship education. Five key actions towards a digital, green and resilient Europe*. Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2826/990680

[36] Sutherland, J. (2014). *Scrum: The art of doing twice the work in half the time*. USA: Crown Business.

[37] Anderson, D. J. (2010). *Kanban: Successful evolutionary change for your technology business*. USA: Blue Hole Press.

[38] Gagne, R., Wager, W., Golas, K., Keller, J., & Russell, J. (2005). Principles of instructional design. *Performance Improvement*, *44*, 44–46. htttps://doi:10.1002/pfi.4140440211

[39] Fitsilis, P., Damasiotis, V., & Boti, E. (2023). Agile learning: An innovative curriculum for educators. *arXiv Preprint: PPR776403*. https://doi.org/10.32388/rqx9t9.3

[40] Larman, C., & Vodde, B. (2016). *Large-scale scrum: More with LeSS*. USA: Pearson Education.

[41] Neumann, M., & Baumann. (2021). L. agile methods in higher education: Adapting and using eduScrum with real world projects. In *2021 IEEE Frontiers in Education Conference*, 1–8. https://doi.org/10.1109/FIE49875.2021.9637344