Terje Väljataga
Mart Laanpere (Eds.)

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Shaping the Digital Transformation of the Education Ecosystem in Europe

31st EDEN Annual Conference 2022
Tallinn, Estonia, June 20–22, 2022
Proceedings

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Editors
Terje Väljataga
School of Educational Sciences
Tallinn University
Tallinn, Estonia

Mart Laanpere
Centre for Educational Technology
Tallinn University
Tallinn, Estonia

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Preface

We are pleased to welcome you to the proceedings of this year's European Distance and E-Learning Network (EDEN) conference, held during June 20–22, 2022, on the theme of "Shaping the digital transformation of the education ecosystem in Europe". The EDEN annual conference has been held all over Europe since 1992, being a meeting place for researchers and practitioners to promote and develop distance education, e-learning, and related applications in a variety of pedagogical fields. The successful collaboration of researchers, politicians, and practitioners from Europe, Asia, and America has been facilitated by this yearly conference series to maximise international exchange of experience and expertise, strengthen and deepen working relationships, form new partnerships, and refine best practices in the area.

This year a hybrid conference was hosted by Tallinn University in Estonia, one of the leading countries of the ICT-driven innovation in education. During the COVID-19 pandemic the digital ecosystem of education has experienced challenges as well as innovation boosts within Europe and beyond. Shaping the digital transformation of the education ecosystem is a challenging endeavour, which needs thorough research and visions from different perspectives and levels. This year's conference was intended as a continuation of the efforts of EDEN to support educators by providing a space to explore the issues and insights that have emerged.

The EDEN 2022 conference encompassed research from innovative technologies to post pandemic changes and new digital learning environments, from inclusive education to various pedagogical models and approaches, and from teacher training to student learning and knowledge building.

We received 78 submissions, of which 11 full papers and two short papers are presented in this proceedings. Each paper was reviewed by at least two members of the Program Committee. The papers, which did not pass the scientific double-blind review process, but consisted of important research or a theoretical approach that was relevant to the community, were presented at the conference. In addition to these 39 interesting presentations, invited keynote speakers provided a lot of food for thought:

- Nicole Johnson (Canadian Digital Learning Research Association) - The Impact of the COVID-19 Pandemic: Implications for the Future of Higher Education
- Karl Vilhelm Valter (Tartu University) - A Student's Perspective on Digital Education
- Lesley Gourlay (Institute of Education, UCL) - There Is No 'Virtual Learning': The Materiality of Digital and Distance Education
- Kyungmee Lee (Lancaster University) - A Purposeful Design for Transformative Distance Education: Staying Different, Making Difference
- Mart Laanpere (Tallinn University) - Digital Education Ecosystem in Estonia
- Riina Vuorikari (JRC Seville) - DigComp 2.2: Helping Shape the Education Ecosystem in Europe

We hope that everyone who was in one way or another engaged in the conference—authors, keynote speakers, PhD students, and organizers—benefited from attending EDEN 2022 and was able to leave with a wealth of thought-provoking conversations, expanded research networks, and priceless memories of Estonia.

We would like to thank all the authors who contributed to the conference, as well as the Program Committee members for their time and expertise.

We would also like to add that the organisation of the conference and its proceedings has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 856954.

June 2022

Terje Väljataga
Mart Laanpere

The original version of the book was revised: the acknowledgement sentence and grant number have been added in the Preface. The correction to the book is available at https://doi.org/10.1007/978-3-031-20518-7_14

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Contents

Digital Competencies

Inclusive Education

Higher Education

Redesigning Presence for Master Curricula

A Case Study for Extra-Occupational Studies

Günther Kainz(✉), Corinna Petra Raith, and Heike Strumpen

Department for E-Governance and Administration, University for Continuing Education Krems, Dr.-Karl-Dorrek-Straße 30, 3500 Krems, Austria
{guenther.kainz,corinna.raith,heike.strumpen}@donau-uni.ac.at

Abstract. Master's programs for extra-occupational studies aim at the academic further education of people with diverse educational prerequisites and professional backgrounds. Due to this and the target group's specific requirements and needs, designing curricula, didactic concepts, and employing appropriate methods and learning activities is challenging. In this regard, the emphasis is on using digital forms of teaching and learning and providing guiding learning materials for individual preparation and follow-up, opportunities for interaction, coaching, and interactive teaching formats to support knowledge transfer of digital competencies in line with the European Digital Competence Framework for Citizens. The COVID-19 pandemic reinforced these challenges. In this context, this paper reports on two extra-occupational management-related master's programs (MSc, MBA) established for working professionals. The programs' curricula and guiding principles based on a blended-learning concept are presented, elucidating the potential and strengths of student-centered teaching methods like problem-based learning and Harvard MOC business cases. Then, the paper outlines the redesign of the blended-learning concept and didactic methods during the pandemic, focusing on time spent together in (virtual and hybrid) presence phases and the lessons learned thereof. Finally, arisen efforts, the value contribution, student acceptance, transferability aspects are discussed, and recommendations derived.

Keywords: Master's programs · Curriculum design · Academic continuing education · Extra-occupational studies · Blended learning · Problem-based learning · Teaching on-site · Online teaching · Hybrid teaching · Online and hybrid course settings

1 Introduction

Lifelong learning, known as the steady development of one's personality and professional knowledge and skills, is a crucial success factor for adults in employment; in fact, not only to bring forward one's career but also to stand the pace [9]. Therefore, public and private educational institutions flourished with success, launching workshops, seminars, and certification programs. Gradually, also universities recognized the potential of further education and implemented new (post-graduate) study programs, explicitly addressing companies' and employees' needs in many different fields [3].

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In the context of higher education, prior work mainly focused on blended education approaches in teaching (e.g. [2, 12, 14, 15, 16]) and on challenges in digital education and digital learning in general (e.g., [6, 8, 14]) on the one hand, and—driven by the COVID-19 pandemic—on changes to teaching and challenges associated with online and hybrid settings on the other hand (e.g., [1, 11, 13]).

This paper reports on two university degree programs employed at the University for Continuing Education Krems, a public university in the German-speaking area, incorporating these aspects in a best-practice case referring to continuing education. In this regard, teaching and learning are geared to the specific target group, namely working professionals, thus, people with professional experience who are fully involved in an active work environment and a private family life, with limited time resources for attending a series of lectures due to their responsibilities. Hence, continuing-education programs must adapt their goals to their audience, their expectations, and knowledge even more than basic university studies, meeting adult-orienting learning needs and aims at the same time [2]. The university has addressed these needs by designing innovative blended learning-based programs that embrace a targeted use of digital and online tools, asynchronous work phases, and synchronously conducted lectures and learning activities in class, supporting extra-occupational studies, individual learning processes, students' motivation, reaction speed, and flexibility. Blended learning might be realized on a continuum between traditional face-to-face learning and pure online distance learning [17]. Teaching contents are research-based, innovative, interdisciplinary, practically and competence oriented. For this reason, external experts from practice support internal faculty; teaching is student-centered and focuses on the interaction between lecturers and students.

In the following, the two programs will be presented in more detail. Within these programs, curriculum and course design had already embraced digital teaching and learning forms as essential parts before COVID-19. However, the pandemic and its consequences, involving social distancing, home office, and online teaching (emergency online teaching, [18]), have demonstrated that progressive digitization not only makes the use of new media-based formats possible but also enables lecturers and program managers to link these formats to the students' individual living and learning situations [11]. To illustrate this, the residual part of this paper is organized as follows: First, both programs will be outlined in their pre-pandemic form with a focus on the didactic design and presence phase within the blended-learning approach. Second, the pandemic-induced redesign and the lessons learned thereof are presented. Third, in the discussion section, the programs and the redesign are discussed regarding arisen efforts, value contribution, student acceptance, and transferability. Finally, recommendations and conclusions will be derived, providing educators and program managers with valuable insights into the programs' specialties and the pandemic-related adaptions that helped achieve previously formulated goals and learning outcomes. In this regard, changes in the didactic setting, methods used, and the targeted utilization of technology supported the further achievement of adult learners' needs adequately and maintained the programs' strengths in these extraordinary times.

2 Best Practice Case for Extra-Occupational Studies

2.1 Curricula Development and Guiding Principles of the Master's Programs

In the following, two master's programs of the university are outlined: "Management and IT" (MSc degree program) and "Digital Corporate Governance" (MBA degree program), developed by the university's Department for E-Governance. Both programs focus on the holistic management of institutions in business and administration, mastering the challenges through digital change. The department's overriding goal was to sustainably teach content and methods required for the goal-oriented use of information and communication technologies. Here, the underlying motivation was to intensify the student-centeredness through individually designed learning phases on the one hand and to increase competence orientation and the connection between theory and practice on the other hand [4]. A general understanding is that joint presence phases are critical because learning is always socially and biographically constructed [5]. However, the working target group's particular requirements in terms of adult learning needs, predictability, and limited time resources should be met in the best possible way. Regarding this, four fundamental questions guided the programs' development:

- How can we create innovative and successful academic didactics, facilitating the course of studies for employed students through clear structures and guidelines?
- Which elements can ensure student-centeredness in the best possible way?
- How and by what means might we boost competence orientation in the curriculum?
- Which aspects of internationalization should we intensify to address future challenges?

Based on faculty discussions of and work on these questions, curricula for two programs were derived. Both the MSc program and the MBA program share a two-semester core curriculum. Here, management-related problems and issues are in the foreground, discussed based on literature and theory on corporate governance, focusing on digitalization and its potential for businesses and society. Topics, thereby, range from basics in management and economics, controlling, strategy, business and digital trends, business innovation methods, law, process management, and information security to scientific methods, providing students with a comprehensive basic understanding of current and future issues related to successful and sustainable management. The core curriculum is followed by a target group-specific specialization semester to extend and deepen the gained knowledge and skills, considering students' interests and backgrounds, and subsequently writing a master's thesis in the respective topic area. The programs' curricula are organized in modules in which the different subjects are taught.

Differences between the MSc program and the MBA program arise in their target groups, topics and methods in the specialization semester, and the specific learning objectives. The MSc program "Management and IT" primarily addresses people with experience as innovation or technology managers who contribute to strategic and innovative projects within enterprises and organizations and contribute to their success. In contrast, the MBA "Digital Corporate Governance" program's target group consists of people in higher leading positions with direct responsibility for their organization's

economic well-being. Attending the programs is predominantly driven by the wish for personal and professional advancement, being prepared for the upcoming challenges of digitalization, and expanding one's professional network. Most students of both programs have their origin in the German-speaking area (Austria, Germany, Switzerland) but differ in age, educational background, and professional experience.

2.2 Underlying Blended-Learning Approach

The department designed a target group-specific blended-learning (BL) concept to address students' requirements and particular needs. The approach was introduced in 2010, comprising synchronous and asynchronous learning formats, with well-defined phases of guided but individual preparation and aggregated attendance blocks (presence phase), followed by an individual follow-up phase and a concluding performance assessment. Therefore, the department deliberately adapted the university's general guidelines regarding design and formats to the programs' respective objectives, including self-responsible and joint learning [2]. Thus, by default, a module is organized as follows: In the preparation phase, students prepare individually for the presence blocks, using didactically prepared learning materials like study texts and scripts. The presence phase takes place on campus in three-day or four-day blocks, with approximately one block and module per month, and has the goal of a joint knowledge transfer and training, deepening learning content in live settings and case studies from practice. The subsequent follow-up phase serves to reflect and consolidate gained knowledge and skills, learn for an exam, or write a home assignment/seminar paper (see Fig. 1).

Besides, learning nuggets such as videos, links, chats, and e-papers guide students' learning process outside the lectures. So, for example, students use digital flashcards that map the theoretical principles elaborated in the study texts flexibly for preparation and post-processing, based on gamification. Each flashcard contains a question and context. By "playing" through the cards, students receive immediate feedback on their level of knowledge. Furthermore, they can create personal cards or comment on existing ones (e.g., report perceived mistakes). Playing the cards on the flashcard mobile app affords ubiquitous and highly individual learning.

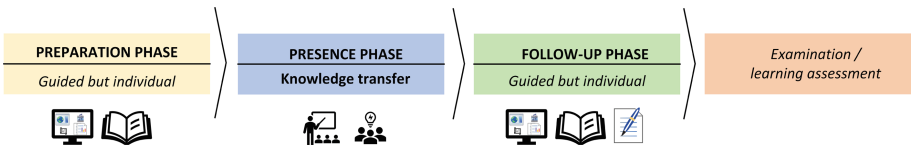

Fig. 1. Blended-learning concept for both master's programs as initiated in 2010

The learning management system (LMS) Moodle serves as the backbone to administer and organize the programs' blended-learning concept. It not only maps the courses in modular form but also creates learning structures. Therefore, the system branches students from the main course into their sub-courses, which map the different phases and the respective blended-learning elements.

2.3 Problem-Based Learning Using the Example of DIG and MOC

Adult learners are currently facing the challenges of managing digital transformation in their working life. Therefore, the "Digital Governance" (DIG) seminar project occupies a unique position in the core curriculum of "Management and IT" (MSc degree program) and "Digital Corporate Governance" (MBA degree program), not only in terms of scope (13 ECTS points) but also forms a thematic parenthesis. Based on concrete problems of companies or organizations, students examine possible strategic, technological, and organizational effects of digitalization with the support of methods like the lean startup, business model, or value proposition canvas. These two semester-spanning projects conclude with a project thesis.

Elements include blocked face-to-face seminars, a boost camp, presentations, and feedback sessions on the project work. In addition, there are distance learning units, online coaching, and guided work assignments in virtual teams. The DIG seminar project follows the problem-based learning (PBL) approach. PBL emphasizes the interactive and comprehensive nature of learning.

As a flexibly structured approach to active learning, PBL follows the basic constructivist idea that knowledge is context-dependent and should be actively constructed through meaning-making activities on the part of the students [10]. In practice, students are confronted with a concrete or abstract "problem" and acquire new knowledge and competencies through collaborative and guided work with this research task while practically experiencing the relevance of this knowledge and the respective competencies. Learning occurs from each other and together through repetitive research processes, targeted feedback, and ongoing reflection. The goals of PBL include helping students develop (1) flexible knowledge, (2) effective problem-solving skills, (3) self-directed learning skills, (4) effective collaboration skills, and (5) intrinsic motivation [7]. In this process, the role of the lecturer shifts from that of the traditional knowledge broker to the preparation of a structured learning process, the supportive guidance of students, and the promotion of regular, critical reflection [10].

The aim of the DIG seminar project is that students expand joint learning, digitalization knowledge, and methodological skills, which are essential competencies for digital transformation. Accordingly, a teaching team provides content-related and practical support in terms of PBL. This teaching team consists of academic staff members and experts from (startup) practice who coach the work on the assignments (e.g., video pitch creation, product-market fit analysis). Thereby, the target is that the knowledge gained flows back into practice.

The MBA program's specialization semester MOC "Digital Competitiveness" (MOC stands for Microeconomics of Competitiveness) explicitly addresses the European and international orientation. The learning materials are based on the documents of the MOC Affiliate Network of the Institute for Strategy and Competitiveness of the Harvard Business School by Michael Porter. In the preparation phase, students must prepare questions on the business cases individually, which are discussed in the presence phase under the guidance of the students with the help of the lecturers (flipped classroom). Using the example of numerous international case studies, students get insights into the essential concepts and strategies for improving the competitiveness of companies, industries, clusters, regions, or countries. In the follow-up phase, students place what

they have learned in a European context or reflect on the lessons learned for the industry in which they work.

"International Experience" in the MBA program stands for excursions to countries in the EU or preferably to the non-European economic area. The aim is to deepen subject-relevant content for managers in a multicultural context (experiential knowledge). Due to the pandemic, this format had to be temporarily substituted in a hybrid form. Summarized, the MBA specialization semester contributes to sharpening students' managerial, strategic and intercultural mindset and related competencies by interactively integrating and employing well-developed and established business cases from different regions and by fostering international exchange through both study trips and guest lectures and inputs of international experts on the course to cope best possibly with emerging challenges in an increasingly digitalized and globalized world.

2.4 Redesigning Presence - Lessons Learned

Before COVID, the departments' academic program management generally coordinated modules and presence blocks with internal/external lectures, supported by an administrative assistant for organizational issues, and was responsible for organizing the courses in the university's LMS Moodle, including students' learning journey, study texts, flashcards, and course materials in time. Nevertheless, lecturers were usually responsible for the course designs, developing specific content, and giving their lectures within the presence blocks on campus.

With the rise of the COVID-19 pandemic in the summer term of 2020, it was necessary to quickly switch to a pure online setting (emergency online teaching, [18]). To master the unfamiliar circumstances and suddenly arisen challenges in online teaching, the department decided to accompany lecturers in their courses. So, the academic program managers, or administrative assistants, took up a co-moderator role, serving as a technical and emotional backup and assistance for small tasks as well as supporting a convenient teaching and learning atmosphere (live on Zoom). Over the summer, the department evaluated the experiences made and initiated an improvement of online lectures in terms of the didactic concept and teaching methods to maintain high-quality lectures and the previously intended learning outcomes, skills transfer, and introduced standards to foster predictability for the students. For these reasons and to detect lecturers' potential training needs, the departments' academic program management intensified the coordination with the internal and external lecturers, organized virtual networking meetings to coordinate and discuss suggestions for improvement, and methodological as well as didactic recommendations.

Accordingly, the blended-learning approach was also adjusted, including additional online evening sessions in the preparation and follow-up phases. Thus, first, joint virtual kick-off sessions via Zoom were introduced to guide students in preparing the virtual presences. These sessions were administered by the internal program management together with the modules' lecturers to outline the upcoming presence blocks, provide impulses, and introduce module contents. Also, in the follow-up phase, a joint virtual follow-up or closing session was established, held by the lecturer(s) responsible for the

current performance assessment, to extend inputs, jointly reflect on the lectures, and provide students with the opportunity to ask questions relevant to home assignments/seminar papers or exams (see Fig. 2).

Besides, the department reformed the virtual presence phase and defined new standards for lectures:

- The planned full-day teaching units were shortened due to a reduced attention span in an online setting (9:00 a.m. - 3:30 p.m.). To some degree, the mandatory virtual kick-offs and follow-up sessions contributed to closing the resulting time gaps.
- Teaching sessions were structured more iteratively to improve students' concentration, consisting of alternating input, training, and reflection phases. Therefore, lecturer-centered theory inputs were shortened in favor of an interactive dealing with topics in collaborative group tasks, worked on in small groups in Zoom breakout sessions and with Mural whiteboards for working notes and outcome records, and succeeding discussions of the work results.
- The role of "co-moderation" to support lecturers was extended and officially introduced. Its responsibility was to ensure a positive working atmosphere and provide content-related and didactic support. This role was then either taken up by the program managers or by a digital teaching assistant.
- To implement these issues in the best possible way, every lecturer had to provide a comprehensive and detailed "script" encompassing a schedule, matters to be handled, didactic elements and aids used, and people involved.

In addition to these endeavors, the department created virtual socializing and networking opportunities outside class (e.g., by using the socializing app Wonder.me) and actively promoted them among students and lecturers.

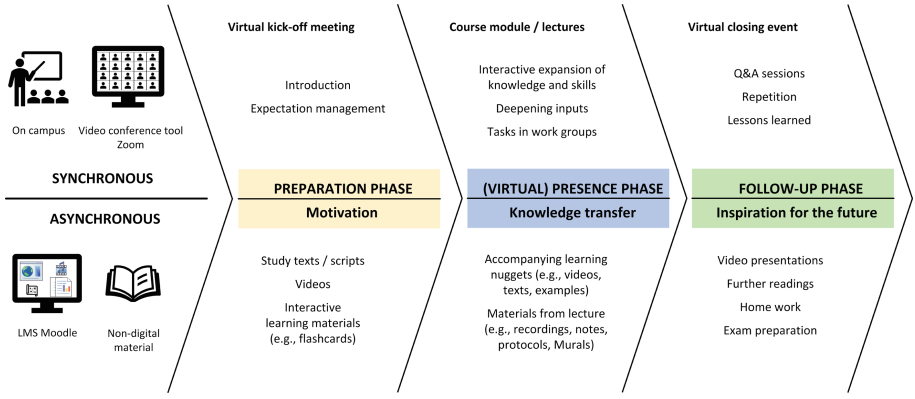

Fig. 2. Adapted blended-learning concept during the COVID-19 pandemic

With the winter term of 2021/22, the presence phase was switched to a hybrid design (as far as the pandemic allowed). In this setting, a sub-group of the students and partly

lecturers virtually join the courses held on campus. For this set-up, the department accommodated the existing standards and introduced new recommendations and guidelines for teaching:

- Since lecturers and students had requested this, teaching times have returned to default mode (9 a.m. - 5 p.m.).
- Despite this, the department has maintained the virtual kick-off and follow-up sessions due to the positive experiences.
- More guest speakers are brought in for impulses or discussion sessions to further increase students' attention in class.
- The department still supports lecturers in their planning process and the (technical) implementation of their courses on-site to ensure a high quality of teaching, learning outcomes, and integration of the virtual student group.
- For hybrid (mixed) student workgroups within sessions, meeting rooms with conferencing equipment have been made accessible on campus.
- For (virtual) collaboration outside the courses, MS Teams channels, and Zoom rooms have been established for students in addition to the existing tools.
- Also, students sometimes still use Wonder.me to socialize with their peers and lecturers after the virtual evening sessions.
- Besides this, the department has established regular virtual network meetings with lecturers as a valuable platform for exchange.

3 Discussion

3.1 Added Value

Continuously adapting curricula in terms of content, competencies to be taught, and the didactic design with the help of new media and technologies is the task of every university. With the introduction of problem-based learning (PBL), it was possible to increase the didactic competence of the lecturers regarding Harvard MOC business cases and the problem-solving competence of the students, especially against the background of their professional challenges. In addition, by sharpening their reflective skills and establishing a constructive feedback culture, students were taught self-reliance, self-organization, and the intended use of learning strategies. The learning outcomes of the DIG seminar project provide lasting evidence in this regard. Students implemented most of the developed projects in their companies, and these projects served as best practices.

Another added value is that students link the use of digital media and virtual teaching-learning settings with their lifeworld and develop a kind of digital networking competence. For example, students started to apply Scrum or Design Thinking methods and corresponding competencies in their working environment and reflected on them in the specific context. Thus, digital competence or technical problem-solving competence per se is promoted as well as a sustainable transfer to students' everyday world in line with the European Digital Competence Framework for Citizens.

By using and testing a wide variety of digital teaching and learning tools during the pandemic, not only students' digital competencies were trained, but also those of the scientific and administrative staff.

For the students, the use of the tools made the individual learning process more flexible. This flexibilization did not generate any additional effort for the students in terms of direct support or administration, as it was made transparent, comprehensible, and supported by the new mapping of the curriculum in the learning management system (LMS) Moodle. In particular, the conversion of the LMS Moodle provides students with a clear structure and information on the learning journey for each module, and the possibility of repeatable learning occasions, eliminating the inequality of prior knowledge or experiences in an individual and self-directed way.

3.2 Acceptance of the Redesigned Presence (Classroom) Phase

In general, the department evaluates the acceptance of the redesigned presence phase and blended-learning concept through the following channels:

- student feedback (evaluation standardized or informal),
- quality of learning output,
- feedback from lecturers,
- feedback from advisory boards.

Students evaluate every course using online questionnaires on didactics, learning materials, lecturers, and workload at the university. In addition, students can also give individual assessments in free text fields. The results of these surveys are stored in the central evaluation system (Evasys). An example of this is the result of students' feedback on the opening session of the DIG seminar project (Evasys) on 06.11.2020. Overall, the course was rated "Very Good" (median) and 1.4 in the mean ($n = 41$). Excerpts from the individual comments underline this result (translated from German):

- "Great. Excellent impulses, practical work, useful exercises, and group work for project work."
- "Very intense but learned a lot. Great people from the business world. Online is definitely more exhausting than offline interaction - and fortunately, there was an opportunity to exchange ideas with colleagues (coffee chats)."
- "Excellent lecture days; I was able to take away some things and hopefully use them in the professional environment to think about."

Another indicator of the acceptance is the work groups' results of the DIG seminar projects (online implementation from 2020/21). The selection of topics alone, from "Digitization of Business Areas to Strengthen Market Position in Stationary Retail" to "Predictive Customer Support" and "Perfect Matches in Blood Plasma Research and Preparation", demonstrates that the interweaving of theory and practice has been successful. The following graphic recording from the groups' final project presentations provides an overview of all topics students worked on during this academic year (see Fig. 3).

The many projects subsequently implemented in practice underline the successful transfer into practice.

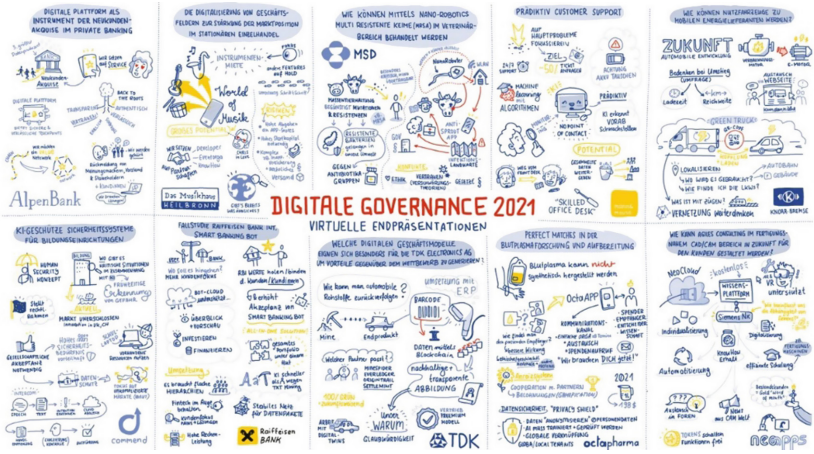

Fig. 3. Graphic recording of the final presentation of the DIG seminar projects (2020/21)

To further investigate students' acceptance of the adapted blended-learning concept and the redesigned presence phase and its quality, we collect data in an ongoing project on students' perceived learning achievements and satisfaction with the current teaching mode in the virtual closing events after each presence phase. The aim is to analyze these data in a longitudinal study combined with the course evaluations and students' actual academic achievements' development in terms of course grades at the end of the study year. Questions are formulated as statements to be rated on a five-point Likert scale, e.g., (i) I have learned a lot in the last presence phase, (ii) At the moment, I am satisfied with my learning progress in my studies, (iii) I am satisfied with the current teaching mode, (iv) In the current setting, I feel well integrated into the lessons, (v) I feel part of the student group of our class. In addition, an open answer question on further issues enables students to anonymously communicate any needs not covered by these items.

3.3 Effort

As indicated, in the virtual and hybrid settings, an increased development effort occurred first in adapting the underlying concept and then in the current implementation. Additional effort emerged for the coordination with the (internal/external) teaching staff. Likewise, accompanying the lecturers bound additional resources.

Various platforms and tools have delivered the digital learning environment, notably Moodle, Mural, Wooclap, Wonder.me, and Zoom. Appropriate technicians are needed to implement and maintain the software. In addition, licenses for commercial software had to be acquired occasionally.

Two academic staff members continuously supervised the (virtual and hybrid) presence phases of the master's programs to make the interaction in virtual classroom phases and virtually joining groups as efficient as possible. Also, experts or guest speakers were invited for additional theoretical input in individual cases.

3.4 Transferability

In particular, the department and the university will incorporate the experiences gained from redesigning the presence (classroom) phases and the problem-based learning (PBL) approach into the future design of hybrid courses and seminar series, organized in cooperation with partners from politics and business.

Summarized, the department created an innovative blended learning concept (BL) with clear structures, standardizations, and specifications that can be easily mapped in the learning management system Moodle without higher effort.

In addition, the adaptations make clear the ongoing need for further training in media competence and didactics among those involved in teaching.

Teaching based on the Harvard MOC business case method is transferable to all management-oriented courses at the university and underlines the aspect of European and international orientation. In particular, the background that the challenges of digitalization do not stop at national borders is essential.

4 Recommendations and Conclusion

The department has gone through "difficult" and exciting times during the COVID-19 pandemic like other institutions. The immediate need for social distancing and the sudden change-over to online classes were challenging to everyone involved, the department's staff, lecturers, and students. However, we had to take up the challenge and accept it, reacting fast, flexible and targeted. Already on day three of the nationwide lockdown, we introduced an online consultation with students. Likewise, lectures were instantly adapted to the new conditions. These achievements were made possible through the departments' distinct innovation orientation and the staff's and lecturers' well-developed didactical and technological skills that were already present before the pandemic and further supported by students' affinity and willingness to use digital technologies and try out new tools.

With rising experience, teaching and the related processes could be continuously improved and adapted to the current needs—with success. Especially after the departments' first revision of the presence phases with a new didactical concept, additional tool usage, and the introduction of kick-off and follow-up sessions, students were not only contented with the procedures and learning journey but also demonstrated their acquired knowledge and skills in terms of outstanding performance and grades. These positive changes applied to the whole core curriculum and specialization semester, but especially to students' work on their DIG seminar projects in both programs, supported by a problem-based learning approach, as well as the work on Harvard MOC business cases in the specialization of the MBA program.

Also, lecturers widely recognized the redesign's potential and advantages for online and virtual classroom settings. On the one hand, a more detailed lesson planning with fine-grained sequence plans was perceived as valuable and supportive for smooth and well-filled lecture days and to achieve the intended goals and outcomes—especially regarding shortened lessons in the complete online setting. Second, the close communication and collaboration with the academic program management, establishing

a co-moderating role, and technical assistance in administering online and hybrid sessions comforted lecturers. So, they could outsource potential technological hurdles and administration to a high degree and were, therefore, able to entirely focus on teaching and interacting with students. Furthermore, more detailed planning and co-moderation relieved potential stress and helped generate a general feel-good atmosphere.

Summarized, the critical success factors of the department's adapted blended-learning concept were a combination of the following aspects:

- the use of appropriate technology (video conferencing tools like Zoom and assisting tools like the whiteboard application Mural),
- the communication and socializing of students with each other and with the lecturers (Zoom chat, Zoom breakout sessions, Wonder.me),
- extensive interaction and active participation in the (virtual) presence phase, to learn by working on topics and tasks in small teams, using adequate working tools, and discussing the outcomes (Mural; Wooclap for votings),
- the precise planning of the course days (presence phase) with the help of a detailed schedule (script),
- the technical and administrative support of lecturers during their teaching sessions, and
- the program manager's role in accompanying students on their learning journey, fostering social relationships with the student group, and students' perceived encouragement through the department.

To put the case into a nutshell, we summarize that (1) innovative university didactics succeed by means of blended learning with a clear structure and specification, (2) student-centeredness is the best possible way by designing individual learning phases, (3) competence orientation can be achieved in the curriculum by clear communication of learning outcomes and by connecting of theory and practice, (4) the European and international orientation are strengthened in the area of "International Experience" and the specialization "Digital Competitiveness" with Harvard MOC business cases.

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Valuable Features of Hybrid Teaching in a Higher Education Context

Marina Marchisio[1], Sergio Rabellino[2], Fabio Roman[1], and Matteo Sacchet[1](✉)

[1] Department of Molecular Biotechnology and Health Sciences, University of Turin, Via Nizza 52, 10126 Turin, Italy
{marina.marchisio,fabio.roman,matteo.sacchet}@unito.it
[2] Department of Computer Science, University of Turin, C.so Svizzera 185, 10149 Turin, Italy
sergio.rabellino@unito.it

Abstract. Even if there is no precise definition of hybrid teaching, it is generally referred to as having both face-to-face and remote audiences for the same class of students. Hybrid teaching has peculiar features in the way it integrates technology into educational spaces. This paper aims at understanding how first-year university students approach and take advantage of the features of hybrid teaching. The research has been carried out through a quantitative and qualitative study within a first-year module in Mathematics and Biostatistics at the Bachelor's degree in Biotechnology at the University of Turin. In this module, students could not only choose whether to attend classes face-to-face or remotely, but they were also supported by an online course with all the useful contents: recording of lectures, presentation of course contents, interactive resources, in-depth materials, and assessment with feedback. Results show a high appreciation of hybrid teaching and its benefits, usefulness, simplicity, high flexibility, facilitation of students' time management, and fulfillment of learning needs, giving additional value to face-to-face attendance.

Keywords: Digital education · Hybrid teaching · Online learning

1 Introduction

The goal of integrating technologies in education is to improve the quality of teaching. There are different ways of using or integrating technologies in education. The first one is face-to-face classes, which take place in a traditional "brick-and-mortar" classroom where technologies may or may not be used. The second one is blended learning, where face-to-face classes are combined with technology to deliver content and assess students. The third one, hybrid teaching, incorporates technologies to enhance students' learning, combining face-to-face activities with technology-mediated ones, so that learners can be activated both inside and outside the classroom, even at the same time. The last one is online learning, where nearly all activities and interactions take place online. In this overview, the focus of this work is hybrid teaching, which provides great learning

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opportunities and has been practiced for many years. The two main reasons to appreciate hybrid teaching are flexibility and the unified experience offering the best of the face-to-face and online world. In this paper, we are going to address students' approach and experience of hybrid teaching within a first-year module in mathematics at the bachelor's degree in Biotechnology at the University of Turin. Previous similar versions of the module were already considered in other research outputs about the problem solving approach [1, 2] and the transition from blended to online learning [3]. The research has been carried out through a questionnaire that students had to submit before examination and after "hybridly" attending classes, face-to-face, online, or in any kind of mix between the two ways. Section 2 presents part of the literature about hybrid teaching and its adoption. Section 3 outlines the research question and methodology. Section 4 shows the results obtained from the students, while Sect. 5 is devoted to the discussion of the results and conclusions.

2 State of the Art

Good teachers help students in their learning both inside and outside of class [4]. Since the first usage of electronic means in education, several studies have investigated the differences among teaching models. An example of a traditional face-to-face lecture or tutorial teaching model with a hybrid flexible delivery model was studied in [5]: they delivered a module using a combination of face-to-face seminars and electronic delivery and communication tools. They found that academic performance is higher for students who studied under the flexible delivery model. Teachers that aim at using hybrid models in education need to reach a balance between the course contents, the pedagogy, and the technology, for which they must be trained and oriented. An example of a model that attempts at identifying the knowledge required by teachers to integrate technology in their teaching, while addressing the contents of the discipline is represented by the TPACK, Technological Pedagogical Content Knowledge [6]. The TPACK approach tries to expand the perceived isolation of the three pieces of knowledge, seeking what is peculiar in the intersections between the three primary forms. The integration of technology while planning the learning activities can adhere to different models, among which is the SAMR model [7]. This model includes 4 different approaches to new technologies: substitution, in which technology directly substitutes traditional methods and resources; augmentation, in which technology provides functional improvements in the design of teaching activities; modification, in which technology affects the redesign of the learning task; redefinition, in which technology allows to create new tasks, inconceivable in the face-to-face model. The SAMR model is characterized by a progression, in which every step is an improvement in students' engagement and learning outcomes. Even the COVID-19 pandemic contributed to boosting the spread of technologies in education. While classroom interaction was made impossible, there was the need to continue and guarantee the practice of hands-on discipline and it was done, for example, with hybrid teaching [8]. In this case, qualitative and quantitative surveys of students indicated the importance of personal exchange, physical proximity, and social interactions. Activities inside and outside the classroom should be aligned and the role of teachers and students undergo significant changes [9]: study is more autonomous and independent, and

instructors must carefully plan the course to have proper alignment between in-class and out-of-class activities. Practice makes perfect: in [10] the importance of knowing-in-practice emerged: rather than acquiring knowledge, a teacher should make space for creation and imagination in using technologies and face the dynamic evolution of higher education. Higher education institutions are investing in technology-enhanced learning spaces, trying to find a good paradigm. In [11], 47 studies were analyzed highlighting optimism about synchronous hybrid learning which creates a more flexible, engaging learning environment compared to other kinds of teaching. Most of the existing literature is exploratory and more research is needed into different pedagogical scenarios and their impact on students' outcomes.

3 Research Question and Methodology

In this research, we are going to explore the hybrid paradigm that was adopted in the Bachelor's degree in Biotechnology within the first-year module *Mathematics and Biostatistics*. The module, beyond content knowledge in Mathematics and Biostatistics, aims at developing students' Computer Science competencies. Lectures were given between two and three times a week. The module corresponds to 8 ECTS, which means 64 lecture hours, that students could attend from home or at the Department of Molecular Biotechnology and Health Sciences. The module was accompanied by an online course in which students could find details about the module, the virtual room for remote lectures and the following recorded videos, shared contents after classes, and, most importantly, online resources and activities for each of the topic of the module, to promote autonomous learning and provide students with a variety of possibilities. The online course was used both synchronously (during lectures) and asynchronously.

Since hybrid teaching should be student-centered, we analyzed the ways students perceived this approach while attending lectures. The question that motivates this research is the following: what are the most valued features of hybrid teaching from the point of view of students? To investigate this matter, we asked students who attended the module during the first semester of the Academic Year 2021/2022 (October 2021 – January 2022) to submit a questionnaire divided into two sections, respectively regarding the course in its whole (lectures, professors, timetable, rooms) and the way hybrid teaching was implemented. The questions, labelled from H1 to H12, are grounded on literature about hybrid teaching. Before the second part of the questionnaire, a definition of hybrid teaching was given to students: *hybrid teaching is a situation where part of the learners follows in presence and part remotely*. The questionnaire was mandatory to take the exam. The questionnaire is composed of Likert scales and open answers. Thus, data analysis combines quantitative and qualitative analysis, with qualitative data supporting the analysis of quantitative ones. Likert scale items results are presented by the median and the IQR (Inter Quartile Range). Moreover, Pearson Correlation Coefficients (PCCs) between different items were calculated, to seek strong (PCC higher than 0.7), moderate (PCC between 0.3 and 0.7), and weak (PCC positive but lower than 0.3) correlations.

4 Results

We collected 82 responses from first-year students. From the first section of the questionnaire, it emerges that the module was perceived as useful and interesting (median 4 over a 5-point Likert scale, where 1 means "Not useful" or "Not interesting" and 5 means "Very useful" or "Very interesting"). Some students attended exclusively face-to-face lectures (17%), others attended the module from home (7%), while most of the students mixed the two possibilities (75%). There were different situational reasons behind students' choices of attendance: students could easily manage their personal timetable (20%), some students also reside outside the city of Turin (12%) and they had trouble with public transportation (5%). The percentage of working students was not high (2%). Many students simply highlighted a preference between one of the two modalities. In the second section, after the definition of hybrid teaching, students had to respond and evaluate how much they agree with 12 statements about hybrid teaching, from 1 ("Not at all") to 5 ("Very much"), according to the definition and what they experienced during the module. Results are shown in Table 1.

Table 1. Median and IQR of students' agreement on statements about hybrid teaching.

How much do you agree with the following statements?	Median	IQR
(H1) Hybrid teaching is useful	5	1
(H2) Lessons attendance in hybrid mode was simple	4	2
(H3) Hybrid teaching has changed my way of attending university	3	2
(H4) I was able to better plan my day knowing that I could choose whether to attend in person or remotely	4	2
(H5) Hybrid teaching met my learning needs	4	2
(H6) I had all the necessary tools available to attend the module in hybrid mode	4	1
(H7) Any technical problems were resolved promptly	4	1
(H8) Hybrid teaching makes me valorize the face-to-face moments	4	1
(H9) Hybrid teaching reduces the dichotomy between face-to-face and distance learning	3	1
(H10) Hybrid teaching creates more continuity between activities with teachers and individual study time	3.5	1
(H11) Hybrid teaching requires more resources and activities to be available inside the online course	4	1
(H12) Hybrid teaching facilitates students with special needs (workers, special educational needs, …)	4	1

The most agreed item is (H1), 52% of students marked 5. Students are aware of the usefulness of hybrid teaching, since it provides them with more opportunities with respect to what they were used to. In fact, a subsequent item asked students to compare

hybrid teaching with exclusively face-to-face or remote lectures: most of the students marked hybrid teaching as more effective, 62% when compared to face-to-face, 85% when compared to remote. According to students, face-to-face teaching was enhanced by hybrid teaching (H8). Moreover, after a pandemic period like the one caused by COVID-19, students are more accustomed to the use of web conference systems and, in general, devices to access courses remotely, as they expressed in (H2), (H6), and (H7).

Among the less agreed items, there are (H3), (H9), and (H10). The changes provided by hybrid teaching are not disruptive. It must be noted that respondents are first-year students, so their touchstone is only represented by other first-year modules. Moreover, even when joined together, face-to-face and distance learning can remain two separate worlds, and a careful design of teaching activities must accompany the adoption of hybrid teaching modalities, as can be also inferred by (H11) about the need for online resources and activities. On the other side, two students openly wrote a useful and effective remark about the module concerning their appreciation for the available contents in the online course, also for students with special needs (H12).

Time management, like in (H4), was one of the positive points that emerged from students and this aspect was greatly emphasized in students' open answers (17%), in connection with other elements, like attending from home (20%).

It seems that, more than expected, hybrid teaching enhanced students' needs (H5): many students reported in the open answers about the use of digital devices that they entered the virtual meeting even when attending face-to-face to have a better view of what was being projected on the main screen of the room (it must be noted that the room for lectures is quite large). Students also used digital devices when attending face-to-face to take notes of the presented contents and to access the online course to reach the resources and activities that were part of the lecture topic.

66 correlation coefficients between items (H1 to H12) were calculated, all of them positive, highlighting a moderate correlation in most of the cases (39 over 66 possible pairings), with 3 strong correlations between (H2) and (H1, H5, H6). The strong correlations could be explained by the possible various interpretations of "simplicity": for a student, simple means usefulness, adherence to learning needs, and availability of tools and devices. It is worth noting the moderate (but almost strong) correlation between (H8) and (H9) (PCC = 0.67), meaning that those students who perceived the enhanced value of face-to-face moments were also feeling a reduced dichotomy between face-to-face and distance, which could be one of the added values. The remaining 24 correlations are weak.

5 Discussion and Conclusions

Students' responses show a positive attitude towards hybrid teaching, even though they may not fully understand what the implications of hybrid teaching are. Students know that their learning potentialities can be strongly enhanced in this way: the easy way of accessing education, the possibility of planning their learning together with personal duties and meeting their learning needs. On the other hand, the percentage of students attending only face-to-face lectures shows that they still favor traditional lecture-based teaching. Hybrid teaching design should also carefully take into account activities and

resources delivered to students, together with assessment, discussions, and interaction. Moreover, teachers should keep in mind social interactions. This is a partial answer to the research question about the most valued features of hybrid teaching from the point of view of students. Further research on this topic needs to be carried out.

Policymakers, administrators, and educators should take these results into account while addressing the challenges of supplying tertiary education to students that demand flexible course delivery to enhance their learning outcomes. The voice of students cannot be ignored: when asked for further comments on hybrid teaching, 12% of respondents reported their belief that hybrid education is a very useful resource and that it should become permanent in the academic years to come.

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Advancement of Online Learning at DOBA Business School on the Basis of the OOFAT Model

Lea Bregar, Jasna Dominko Baloh, and Marko Divjak(✉)

DOBA Business School, Maribor, Slovenia
lea.bregar@net.doba.si, {jasna.dominko-baloh, marko.divjak}@doba.si

Abstract. The purpose of this paper is to present an example of good practice in comprehensive and theoretically and professionally grounded planning and implementation of further development of online learning at DOBA Business School. We decided for the OOFAT model as the starting point. Based on the gap between the achieved and target (desired) levels of subcategories of flexibility and openness of the OOFAT model and taking into account the trends in e-learning and institutional and legal formal constraints, we have prepared five sets of concrete activities to advance the online learning model by 2025. These are: mobile learning, learning analytics, multimedia and interactive learning materials, open education, including open educational resources, and recognition (accreditation). The revised model of online learning will represent a shift towards the third (semantic) generation of e-learning, which will place DOBA Business School close to the leading educational institutions in the field of technology-enhanced education at the global level.

Keywords: Online learning · OOFAT model · Openness · Flexibility · Higher education

1 Introduction

With around 1,500 enrolled students a year, DOBA Business School (DBS) is considered a medium-sized school and is the largest private higher education institution in Slovenia. The school's recognition in the higher education arena in Slovenia and the region is largely determined by its focus on the online learning model, which it has been implementing since 2005[1].

DBS monitors the quality of all elements and phases of online learning with annual internal and external, national and international evaluations, which have been designed in line with international recommendations and standards for the evaluation of online

[1] https://www.fakulteta.doba.si/

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learning in higher education. The quality of online learning at DBS is confirmed by the UNIQUe and the EOCCS international certifications[2].

Despite continuous technological, pedagogical and organizational improvements and almost twenty years of successful implementation, the online learning model at DBS has reached a certain level of maturity. Findings of some evaluations of DBS, and especially the monitoring of development trends in technology-enhanced higher education, indicate that the existing model of online learning at DBS needs to be modernized and revised. Only by revising the model will online learning continue to facilitate and promote the realization of strategic directions of DBS for the 2020–2025 period, which direct DBS towards being the leading international online school in Southeast Europe. The online learning model at DBS was set up in the initial years of development of e-learning, which were marked by the breakthrough of online technologies and the use of social networks (e-learning 2.0), in parallel with the existence of the first generation of static e-learning (e-learning. 1.0). Today, e-learning 2.0 still prevails while many schools have not even exceeded the initial development stage of e-learning 1.0. On the other hand, the third generation of e-learning, e-learning 3.0, has been at the forefront of expert discourse and the development of progressive educational institutions for almost a decade. The main characteristic of e-learning 3.0 is the use of various, mainly mobile digital devices, which enable learning anytime and anywhere. The focus is on artificial intelligence techniques, data mining and other learning analytics approaches that allow us to explore mass data, thus gaining in-depth knowledge of the learning process and adapting the learning process to the real needs of the learner (Bregar et al. 2020, p. 38).

In the 2019/2020 academic year, the 'Framework plan for the further development of online learning at DBS for the 2020–2025 period' project was carried out as part of the internal development program of DBS (Amič Ravnik et al. 2019). The aim of the project was to prepare professional foundations for the further development of the online learning model at DBS by 2025 and to define indicative steps and activities for the implementation of the revised model. The preparation of professional foundations included:

-research of the main factors determining the revision of the online learning model at DBS (educational and technological trends in e-learning and innovative higher education; characteristics of the environment; characteristics and needs of students; business aspects of the existing online learning model at DBS);

-literature review of online learning models and the selection of a model as the theoretical framework for a consistent and comprehensive advancement of online learning at institutional level, taking into account not only educational, but also business, organizational and technological aspects of online learning in higher education.

This paper focuses on the selected model, i.e. OOFAT – online open, flexible and technology-enhanced higher education. This model was developed in 2018 by Orr, Weller

[2] The UNIQUe (European Universities Quality in e-Learning) international quality certification for outstanding use of ICT in learning and teaching is awarded by the European Foundation for Quality in e-Learning (EFQUEL). The EOCCS (Online Course Certification System) certification for the quality of online business courses is awarded by the EFMD (European Foundation for Management Development). DOBA Business School received the UNIQUe certification in 2013 and the EOCCS certification twice, i.e. in 2018 and 2021.

and Farrow under the auspices of ICDE (International Council for Distance Education) as a conceptual and methodological framework for researching technology-enhanced higher education.

The purpose of this paper is to present a good practice case in comprehensive and theoretically and professionally grounded planning and implementation of further development of online learning in a higher education institution.

The paper comprises three chapters and a conclusion. We first set the theoretical framework for exploring advancement possibilities for online learning at DBS by defining online learning, describing the online learning model at DBS and presenting the OOFAT model. We then briefly describe the implementation of the OOFAT model in the last three years since its publication in 2018, as shown by the literature review. In the final part of the paper, we focus on the use of the OOFAT model at DBS. The conclusion assesses the applicability of the model in the light of the experience gained and presents the main features of the revised online learning model at DBS, which have been identified with the help of the OOFAT model.

2 The Theoretical Framework for the Advancement of Online Learning at DOBA Business School

2.1 The Concept of Online Learning

There is a need for a clear and unambiguous definition of what is understood by the concept of online learning when exploring the possibilities of shaping or changing the online learning model in practice. In doing so, we are confronted with a problem that is intrinsically typical of new social concepts and phenomena that are closely linked to technological development. Constant and intensive technological and social changes lead to a continuous change of such concepts, new ones are constantly emerging, and the relationships between them are not clearly defined, all of which creates problems in communication at professional level and in practice.

A review of professional literature also reveals rather non-uniform and changing views on what can be defined as online learning. The first definitions emphasized the connections between online learning and distance education. The authors derived from the common characteristic of both concepts, i.e. better access to education, and pointed out that the use of information and communication technologies further improves this accessibility. In addition to accessibility, subsequent definitions added flexibility, connectivity and interactivity to the characteristics of online learning (Singh and Thurman 2019; Moore et al. 2011). In the definition of online learning, some authors limit themselves merely to technological characteristics. Bates, for example, defines online learning as any form of learning, which is implemented fully or partially online (2016), not focusing on the question of the boundary between online learning and face-to-face learning if the learning process is being implemented online only partially.

It is our opinion, however, that from the viewpoint of the educational institution and the learner, it is essential whether the learning process at the level of an individual course, study program or the entire educational offer of the institution is implemented fully or partially online. In this context, it makes sense to distinguish between two types

of e-learning: online learning and blended learning. Online learning is characterized by full or almost exclusive online delivery, and blended learning is characterized by a combination of online learning and traditional face-to-face learning in the classroom. We understand online learning as a specific form of e-learning, which is a general (umbrella) concept of technology-enhanced learning (Bregar et al. 2020, p. 18).

At DBS, online learning is regarded as a way of e-learning in which the learning process is implemented fully online under conditions of physical and in some cases also virtual separation of teacher and learner. If participants are only physically separated (at another physical location), the learning process takes place simultaneously (synchronously) in the virtual space. However, if participants are separated in both physical and virtual space, from the point of view of the participants the learning process takes place asynchronously. An essential feature of thus defined online learning is that with the help of appropriate technology, the learning process can take place independently of space and also time (in the case of asynchronous delivery). This main feature brings two essential advantages to online learning, i.e. flexibility and openness, but also the challenge of how to manage the problems posed by the separation of participants in the physical and virtual space. Interactivity and connectivity are the basic approaches to overcoming the problem of spatial separation.

The utilization of the main advantages of online learning, i.e. openness and flexibility, and the management of separation issues in the online learning process are achieved through specific pedagogical approaches in the elements that determine the implementation characteristics of the online learning model (i.e. with appropriate pedagogical solutions regarding learning resources and learning activities, assessment, pedagogical and other forms of support, delivery and organization of the learning process)[3].

2.2 The Online Learning Model at DBS

Online learning at DBS primarily targets employed individuals. The online learning model at this educational institution derives from the student (i.e. an employed individual) with specific educational needs and characteristics as the central category of the learning process (student centered approach). From the pedagogical aspect, it is based on the learning theories of constructivism and community of inquiry, offering students the opportunity to combine existing knowledge and experience with new knowledge and to learn through collaboration. From the technological aspect, the learning process is implemented fully (100 percent) online in the Blackboard learning environment, which provides the participants with full spatial flexibility and, to a large extent, also temporal flexibility. The major part of the learning process is designed and delivered asynchronously, with students' autonomous, active and self-regulated learning and work in the implementation of continuous learning activities. These are mostly practice-oriented and linked to students' real-life problems and challenges in the workplace or their broader community. Knowledge and skills assessment is based on formative (continuous) assessment of a range of continuous learning activities that promote various forms of student

[3] More on this in Bregar et al. 2020, 111–197.

interaction, peer learning and teamwork. Pedagogical, technical and administrative support are available to students at all times. Figure 1 shows the online learning model at DBS and its main characteristics.

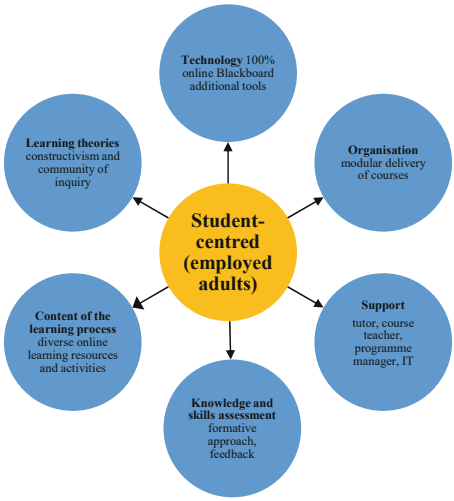

Fig. 1. The online learning model at DBS. Source: Adapted from Geder (2021).

2.3 The OOFAT Model

In order to determine a general direction of revising the existing online learning model at DBS, with an aim to reinforce its role as the main lever for the implementation of the development strategy of DBS in the circumstances of significantly changed technological and social environments (Doba Fakulteta 2022), a simple conceptual framework was required that builds on the main characteristics of online learning, allowing for consistent assessment of all aspects of online learning that are relevant for the educational institution as well as for international comparability. Pedagogical models of online learning that focus on theoretical issues of how to establish a process of knowledge and skills creation among participants in spatial separation conditions, such as the community of inquiry model or Anderson's integrated online learning model (Garrison et al. 2000; Picciano 2017) are not suitable for strategic planning of development at educational institution level. Equally unsuitable for this purpose are business models of e-learning such as Khan's 3P model (Khan 2004), as they neglect or too marginally address the pedagogical aspects of e-learning.

An appropriate tool was found to be the OOFAT model – online, open, flexible and technology-enhanced higher education (Orr et al. 2018; Orr et al. 2019). The OOFAT model was developed in 2018 by e-learning experts under the auspices of ICDE (International Council for Distance Education) as a conceptual and methodological framework for systematically monitoring developments in technology-enhanced higher education in the light of the United Nations Sustainable Development Goals in the field of quality education, in particular Goal 4.3 – By 2030, ensure equal access for all women and

men to affordable and quality technical, vocational and tertiary education, including university (United Nations, n. d.).

The OOFAT model builds on the assumption that the main characteristics of online learning, i.e. flexibility and openness, are manifested in three key categories/processes of higher education studies, which are further classified into subcategories. The basic categories are content, delivery and recognition of the learning program (Orr et al. 2019).

- Content: content (subject) knowledge, which also covers pedagogical approaches, support and guidance and learning analytics, which together make up the entirety of the didactical process.
- Delivery is determined by the qualities of place, pace and timing of delivery of the content as well as the extent of physical and online provision and the question of the timing of key events (e.g. start and end points of learning processes).
- Recognition: characteristics of assessment and accreditation, i.e. formal processes leading to recognition of learning achievements.

The impact of technology on these core categories is expressed through two characteristics or dimensions: flexibility and openness (Fig. 2). Organizational flexibility (Orr et al. 2019) is associated with the question of which categories and how to use digital technology to eliminate or reduce the need for physical presence in the learning process. The level of flexibility is the lowest in the physical and the highest in the virtual learning environment. The dimension of procedural openness (Orr et al. 2019) is associated with the question of who and to what extent they can rely on the principle of openness. The level of openness ranges from closed groups to open networks. Greater openness means fewer limitations on accessibility, delivery, control of content, assessment and recognition. Openness in education is also possible without technological support; however, it is significantly improved by the use of technology.

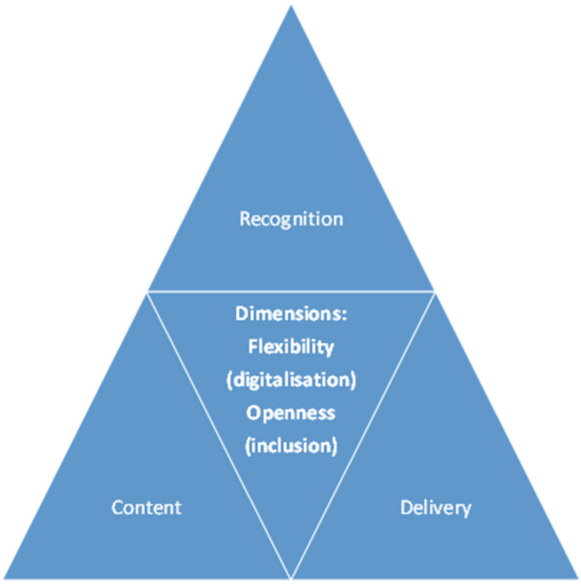

Fig. 2. Categories of the OOFAT model. Source: Orr et al. 2018, p. 9

A more comprehensive description of the OOFAT model can be made on the basis of the subcategories, which are described with the dimensions of openness and flexibility. At the level of subcategories, the OOFAT model thus consists of ten components of open and flexible technology-enhanced learning education. Categories, subcategories and dimensions of the OOFAT model are shown in Table 1.

Table 1. Categories, subcategories and dimensions of the OOFAT model. Source: Orr et al. 2018, p. 16–17.

Category	Subcategories	Dimensions	
		Flexibility	Openness
		What and how – from static to flexible learning process?	Who – from closed group to open network?
DELIVERY	Access to content	❶ How flexible is delivery by time, location and pace?	❷ How open is the institution to all learners?
	Access to guidance and support	❸ How flexible is access to full support?	❹ Who can access support? Who can provide support?
CONTENT	Resources	❺ How adaptable is the content to an individual learner? (personalisation)	❻ How open is the provision of content?
	Assessment	❼ Is assessment static, and one size fits all?	❽ Are there restrictions on who can be assessed? Who does the assessing?
RECOGNITION	Content and process	❾ Can different elements contribute to recognition? Are there flexible paths to recognition?	❿ Is recognition available from multiple groups or one body?

The elaborated OOFAT model allows higher education institutions to easily describe and analyze the level of technology integration in a comprehensive and consistent manner and to compare their situation with other higher education institutions as well as to use it as a basis for designing a development strategy. However, as a conceptual framework, the OOFAT model is of interest not only to institutions already implementing online learning but also to those that are only just starting to implement technologies and digitalization of learning. It is also useful for educational decision-makers when designing policies and measures for modernization (Orr et al. 2018; Orr et al. 2019).

2.4 Implementation of the OOFAT Model in International Research

The elaborated OOFAT model with its 10 components was used as a basis for a rather extensive global survey by ICDE in 2018 on the characteristics of higher education learning in terms of openness and flexibility. The survey covered 69 higher education institutions from 34 countries across the globe (Orr et al. 2018). The component of 'openness of assessment' was not included in this survey and therefore only 9 components of the OOFAT model are discussed and presented in the ICDE report and the collection of cases[4].

The objective of this survey was to identify the characteristics of higher education institutions on the basis of the elaborated OOFAT model in terms of the way and extent to which technological support is integrated into learning processes and, on that basis, to define a typology of models in higher education. The data on the achieved levels of openness and flexibility for the dimensions included in the OOFAT model were collected with an online survey that was conducted among the directors of the participating institutions. A five-stage numerical scale was used, with the scores having the following meaning:

- 1–2: no flexibility and no openness or both dimensions are at a very low or low level;
- 3: solid level of flexibility and openness;
- 4–5: high or very high level of flexibility and openness.

The analysis of the results of this survey showed considerable differences and diversity in the introduction of online open flexible technology-enhanced learning (OOFAT). Higher education institutions, which are still at the experimental level of introducing digitalisation and the use of new technologies, prevail (Orr et al. 2018, p. 12). On the basis of the common characteristics of the surveyed organizations, the authors developed six typologies of OOFAT models (ibid. p. 10):

- OOFAT at the center: the OOFAT model is fully integrated in the institution's vision (14% of the surveyed institutions);
- OOFAT for organizational flexibility: the OOFAT model supports flexibility across all aspects of the conceptual model of higher education (13% of the surveyed institutions);
- content-focused OOFAT: the educational institution concentrates on the elements of content development and delivery (7% of the surveyed institutions);
- access-focused OOFAT: the focus is on access to content and support (9% of the surveyed institutions);
- OOFAT for a specific purpose: OOFAT is focused only on specific aspects of the institution's activity (e.g. one target group or market of educational services and not across the institution) (16% of the surveyed institutions);
- OOFAT for multiple-projects: OOFAT is the basis of different initiatives and experiments and is not a part of the institution's unified strategy (41% of the surveyed institutions).

[4] https://oofat.oerhub.net/OOFAT/collection-of-cases.

A year after the publication of the ICDE report, Cervantes-Perez and his colleagues analyzed the 46-year development of Mexico's national university in three distinct time periods from the viewpoint of achieving OOFAT as the center approach of this institution (Cervantes-Perez et al. 2019).

In the next two years, the use of the OOFAT model extended to other fields. The model was used as the common framework for a program of professional development of academic staff at higher education institutions in Ireland and the United Kingdom (Costelloe et al. 2020). Hassan and Abdullahi (2021) used the methodological approach of a partially modified OOFAT model to assess the success of online learning and teaching during the pandemic with regard to the academic community's previous experience with technology-enhanced provision of content and flexibility[5].

3 Use of the OOFAT Model at DOBA Business School

3.1 Methodology

At DBS, the OOFAT model was used as the conceptual framework for assessing the level of achieved flexibility and openness of the existing online learning model and for preparing a roadmap for its revision for the 2020–2025 period (Master Plan).

The results of the internal evaluation of elements and processes of online learning at DBS, which was implemented as a part of the 'Framework plan for the further development of online learning at DBS for the 2020–2025 period' (Amič Ravnik et al. 2019, pp. 76–102), were used to assess the level of achieved flexibility and openness as the key features of online learning (Fig. 3).

The internal evaluation was carried out in the first half of 2019 and was based on an assessment of the consistency of the process work (phases) and elements of online learning with the conceptual design of the online learning model at DBS (Fig. 1). A detailed substantiation and analysis of evaluation findings further considered international recommendations and standards on quality in e-learning (EADTU 2016; Huertas et al. 2018).

The characteristics of the different phases of online learning (design, development, delivery, evaluation) have been assessed at the level of DBS as an organizational entity, as these phases are implemented uniformly for all undergraduate and postgraduate programs according to pre-defined and clearly specified procedures (content of the different phases, agents and responsibilities, deadlines and other time constraints, quality).

The evaluation of elements of the learning process (i.e. learning resources, students' activities and assignments, assessment, student support, technology integration) was carried out at course level for 12 typical courses in Bachelor programs and 8 typical courses in Master's programs. For each of the evaluated courses, data were collected on the characteristics of each element of the learning process under a uniform classification scheme and then evaluated against the starting points of the evaluation. The findings of

[5] In the first half of 2019, i.e. at the time that we studied the applicability of online learning models for the advancement of online learning at DBS (including the recently published OOFAT model), papers on these surveys had not yet been published.

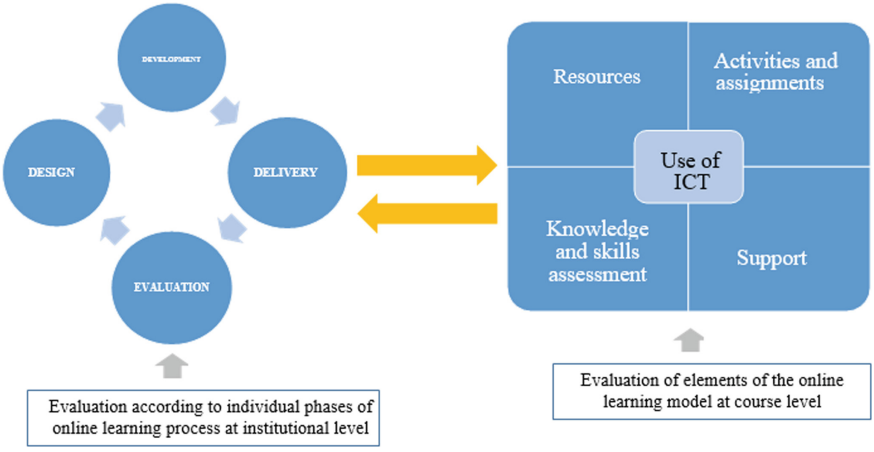

Fig. 3. Outline of the internal evaluation of the online learning model at DBS, 2019. Source: Amič Ravnik et al. 2019, p. 78.

the internal evaluation were then supplemented and validated with the findings of other evaluations of DBS[6].

These findings formed the basis for evaluating the achieved levels of the ten components of the OOFAT model on a five-stage scale. Even though a different breakdown of online learning (processes/phases and elements) was used for the needs of the internal evaluation than in the OOFAT model, there were no particular problems in transferring evaluation results to the OOFAT diagram due to the detailed breakdown of evaluation data and the robustness of the OOFAT model. The project team carried out the evaluation of the level of the OOFAT model in the same methodological way as the ICDE survey (i.e. using the five-stage numerical scale) and with the same questionnaire used by the ICDE global survey for 69 higher education institutions (Orr et al. 2018, pp. 59–63). Due to the broad definition of the components of the model, assessments for some of these components were given in interval format. More precise assessments of the achieved levels of flexibility and openness could be obtained with more elaborate methodological instruments (i.e. by breaking down each component into subcomponents and weighting them according to the relative importance of this component for flexibility or openness).

The five-stage numerical scale was also used to determine the target levels for each of the 10 components of the OOFAT model to be achieved by DBS at the end of the five-year period in 2025. The baseline values of the target levels were proposed and substantiated by the project team and subsequently discussed and confirmed by DBS management. The target levels were determined in line with the main strategic directions of DBS for the 2020–2025 period, which focus on DBS being the leading international online

[6] Information from the following evaluation reports was used:DOBA Business School. (2019). Self-Evaluation Report on Educational and Research Activities for the 2018/2019 Academic Year and for 2018.DOBA Business School. (2018). Self-Evaluation Report on Educational and Research Activities for the 2016/2017 Academic Year.EFMD Global Network. (2018). EOCCS Certified, Online Course Certification System. Review Panel Report.

school in Southeast Europe. Furthermore, we considered the impact of the factors that were examined in the context of the project, i.e. trends in e-learning, the characteristics of DBS students, available resources, other business and institutional circumstances of DBS, and the characteristics and perspectives of the wider environment in which this educational institution operates.

3.2 Presentation and Analysis of Results

Figure 4 shows the achieved level of flexibility and openness of online learning at DBS in 2019. The line closer to the circumferential line of the decagon shows a higher level of flexibility or openness of online learning. The assessment took into account the educational offer of DBS for formal education programs, but not the offer of other (non-formal) forms of education offered by DBS to the community (usually free of charge and whose openness is very high).

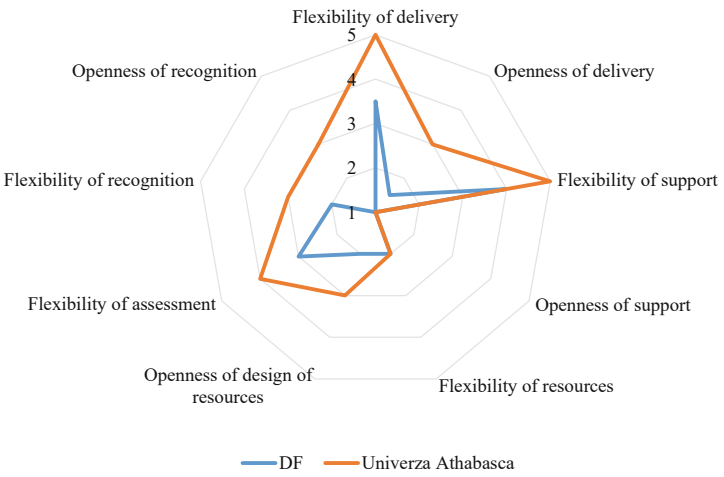

Fig. 4. Assessment of the achieved level of flexibility and openness of the online learning model at DF and at Univerza Athabasca. Source: Amič Ravnik et al. 2019, p. 110; OOFAT Case Collection – Canada, Athabasca University (https://oofat.oerhub.net/OOFAT/collection-of-cases).

Online learning at DBS achieves a rather high level of flexibility in the delivery of the learning process and in student support and a solid level in knowledge assessment, while flexibility is ensured only to a limited extent for resources and for the personalization of content. DBS achieves substantially lower levels in all dimensions of openness. This is largely due to the status of DBS as a private educational institution that cannot afford the offer of open educational services of formal education, as well as to the formal and legal frameworks that DBS must respect in its operations.

The characteristics evident in the existing online learning model at DBS under the OOFAT components (i.e. rather high levels in all subcategories of flexibility and relatively low levels in openness) are described in the ICDE survey as organizational flexibility. This survey has identified nine out of the 69 educational institutions that can be classified into the group of organizational flexibility models[7].

Data for the OOFAT model at the Athabasca University, Canada, which is one of the nine institutions characterized by an organizational flexibility model, are shown for comparison (Fig. 4). At global level, Athabasca University is considered a large, open university with 45,000 enrolled students, corresponding to the enrolment of 7,800 fully enrolled students (complete enrolment in the study program). It is a leading online university in Canada, where online learning is highly established and widespread[8].

A comparison of OOFAT models for Athabasca University and DBS shows very similar relations between the individual levels, with the assessed level for DBS being approximately by one level lower for the majority of the components[9]. A greater deviation is only observed in the openness of formal recognition, where the assessment for DBS is the lowest (1) and for Athabasca University by two levels higher.

4 Revision of the Online Learning Model at DOBA Business School According to OOFAT Components

The assessment of the online learning model at DBS in line with the OOFAT methodology provided an overview as to the extent to which the main advantages of online learning, i.e. flexibility and openness, are already exploited in individual segments of the learning process. It has further shown the possibilities of achieving higher levels of flexibility and openness, taking into account the available resources and the institutional aspects and characteristics of the environment in which DBS operates. It is particularly important that this assessment shows the position of DBS in an international context and can be assessed in comparison with international online educational institutions.

In assessing the extent to which it would be possible to increase the level of openness and flexibility at DBS within five years, the main difference between these two essential dimensions of online learning had to be considered first. The category of flexibility is mainly linked to the pedagogical aspects of online learning and the main lever for enhancing it is the rational use of technology. DBS is largely autonomous in increasing flexibility and depends on strategic decisions and available resources (the only exception is the 'Flexibility of formal recognition' component). However, increasing openness is less dependent on the use of technology and autonomous decisions by DBS. The potential for increasing openness is largely influenced by institutional circumstances and formal and legal frameworks, although technological advancements have also been improving the conditions for greater openness in recent years (in particular in access to content).

[7] The list of educational institutions that are classified in organizational flexibility models is available in the ICDE survey (Orr et al., pp. 50–52), and a full description of each of them can be found at https://oofat.oerhub.net/OOFAT/collection-of-cases/.

[8] https://www.athabascau.ca/.

[9] The 'openness of assessment' component was not included in the ICDE survey. For reasons of comparability, it has also been excluded from Fig. 4.

The limitations of DBS thus primarily lie in the development of the dimensions of openness of delivery, openness of support and openness of recognition of programs (at least within a five-year period). The opportunity for the revision of the online learning model at DBS mainly lies in achieving a very high level of flexibility of delivery, flexibility of support and flexibility of assessment. New technologies and pedagogical approaches also allow for a more visible breakthrough in terms of greater flexibility and openness in the design (development) of educational resources. Flexibility also opens the door to personalized learning, which is one of the key imperatives of 21st century education.

It is our belief that in the light of institutional and other external circumstances, it is not appropriate, over a five-year period, to invest greater efforts into achieving a significantly greater level of openness of formal education programs. Through the use of modern technologies and the achievements of open education, DBS has the potential to increase openness of delivery mainly at the expense of greater access to non-formal education, while more favorable conditions for greater openness as well as flexibility of formal recognition are expected over time. This is also indicated by studies on trends in higher education. While global trends highlight the need for greater flexibility in formal recognition and open recognition of programs, they indicate that this process will be the most intense within the upcoming five to ten years (Ehlers and Kellerman 2019).

These starting points were used to prepare a roadmap of measures and activities for achieving the targets for the dimensions of flexibility and openness of the online learning model at DBS, which was adopted by DBS management as a framework plan for the advancement of online learning at DBS (the Master Plan). Table 2 provides an overview of the proposed advancement of online learning at DBS. The characteristics of the revised online learning model at DBS are reflected by the target values of the OOFAT components and proposed activities and measures.

The Master Plan for the realization of the revised online learning model at DBS has been clarified by detailing and substantiating the measures and activities for each of the ten components of openness and flexibility. Even though the proposed activities are technically distributed according to the dimensions of openness and flexibility, they are intertwined and interlinked. In view of their content, technological and organizational characteristics, the activities have been grouped into the following project packages (tasks):

- Mobile learning,
- Learning analytics,
- Multimedia and interactive learning materials,
- Open education,
- Recognition (accreditations).

The pedagogical approaches and methods included in the project packages for the realization of the Master Plan are specific to the third generation of e-learning in terms of technological support. The introduction of revised/new online learning model (NOLM) on the basis of the Master Plan would thus also mean a substantial shift in the development arc of e-learning from the current second generation to the third or semantic generation of e-learning.

Table 2. Roadmap for the revision of the online learning model at DBS, 2020–2025 (Master Plan). Amič Ravnik et al. 2019 Source:, p. 112.

	Dimensions of the OOFAT model	Activities for the revision of the online learning model at DBS	The online learning model at DBS	
			Assessment of the achieved level	Target level 2025
❶	Flexibility of delivery	Mobile learning	3–4	4–5
❷	Openness of delivery	DBS for the 'community'	1–2	2–3
❸	Flexibility of support	Learning analytics	4	4–5
❹	Openness of support	Learning communities	1	2
❺	Flexibility of resources/personalisation of content	Development of interactive and multimedia resources	2	3–4
❻	Openness of design/development of resources	Model of including OER, digital repository	2	3–4
❼	Flexibility of assessment	Learning analytics	3	4
❽	Openness of assessment	Peer assessment	1–2	2–3
❾	Flexibility of formal recognition	Virtual partnership	2	2–3
❿	Openness of formal recognition	Virtual partnership	1	1–2

Each project package (task) consists of a set of interlinked and intertwined activities, whose realization contributes to the revision of one or more dimensions or components of flexibility and openness of the revised/new online learning model (NOLM). The complexity of project tasks requires that they be carried out according to the principles of project management and support of transversal activities (management, research, training, quality assurance, IT). The realization of the Master Plan is planned in three phases (A: 2020–2021; B: 2022–2023; C: 2024–2025), which would enable the gradual exploitation of DBS resources and realization by 2025. The main project packages (tasks) with the transversal activities are shown in Fig. 5.

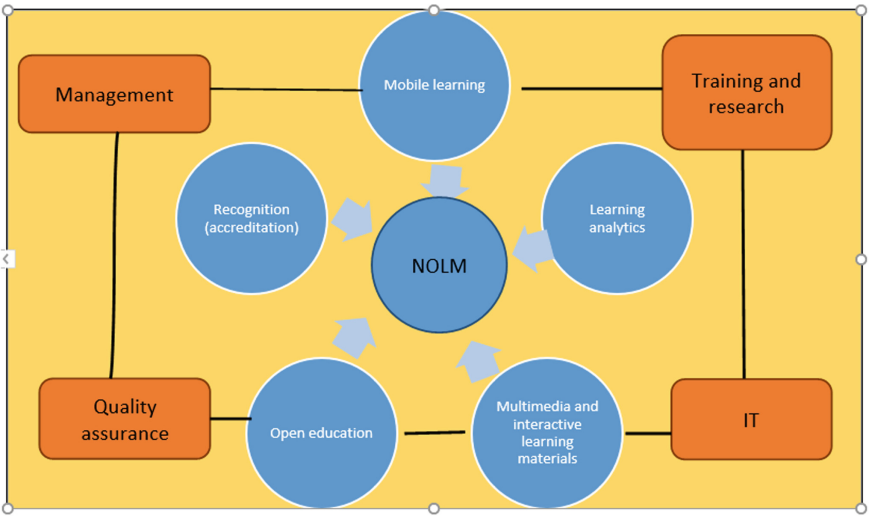

Fig. 5. Project packages and transversal activities for the realization of the Master Plan.

5 Conclusion

The OOFAT model has proven to be a useful tool for developing the roadmap for revising the online learning model. It provides a simple, transparent and consistent description and assessment of the achieved levels of the fundamental elements at the level of the educational institution, which determine the quality of online learning in higher education. The model also allows for international comparisons of higher education institutions in terms of the characteristics of online learning.

The analysis of the achieved levels according to OOFAT dimensions has shown that online learning at DBS achieves a rather high level of flexibility in the delivery of the learning process and in student support and a solid level in knowledge assessment, while flexibility is ensured only to a limited extent for resources and for the personalization of content. Online learning at DBS achieves lower levels in all dimensions of openness. These characteristics put the online learning model at DBS in the group of organizational flexibility models according to the ICDE typology.

A comparison of the achieved and target levels of OOFAT dimensions, which have been established on the basis of strategic directions and in consideration of the potential of DBS and the trends in e-learning, has shown which innovative approaches and innovations should be used in order to revise the existing online learning model. These are: the introduction of mobile learning, the monitoring of the learning process and outcomes through learning analytics, the development of multimedia and interactive learning materials, the integration of open education principles and the use of open educational resources, and, within formal possibilities, new approaches in the field of recognition of study achievements.

Concrete activities, which are necessary for the realization of the individual segments of the project by 2025, have been defined for each of these project packages. The implementation of the Master Plan will contribute to raising the quality of online learning at

DBS and strengthening the position of DBS as a leading institution in quality online learning in Southeast Europe. In terms of development stages of e-learning, the revised online learning model will represent a shift towards the third (semantic) generation of e-learning, placing DBS close (on a comparable level) to leading educational institutions in the field of technology-enhanced education on a global scale.

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Community Building in Post Pandemic Era: Peer Tutoring in Digital Learning Contexts for Soft and Professional Skills Enhancement. A Post-graduate Experience

Antonella Poce[1](✉), Maria Rosaria Re[2], and Mara Valente[2]

[1] University of Modena and Reggio Emilia, 42121 Reggio Emilia, Italy
antonella.poce@unimore.it
[2] University of Roma Tre, 00185 Rome, Italy

Abstract. The aim of this paper is to present the results of a research aimed at analysing the use of community building and the effectiveness of peer-tutoring in a university environment, specifically among students attending post-graduate courses delivered online, to support soft and professional skills. The study examined the online tutoring service offered to students attending the post-graduate courses "Museum Education" and "Advanced Studies in Museum Education", promoted by the Centre for Museum Studies based at the Department of Education - University Roma Tre, during the academic year 2020–21. Both tutors and students were submitted questionnaires in order to monitor the level of usefulness of the service, its strengths, and weaknesses. The results of the peer tutoring experience show that peer tutoring created group bonds and increased the sense of "community", albeit virtual, as well as providing information and support to the students.

Keywords: Peer-tutoring · Tutor · Tutee · Post-graduate courses · Evaluation · Digital learning context

1 Introduction

Learning by imitation is intrinsic to human nature. Peer tutoring has been studied in Bandura's social learning theory [1], in which the term "modelling" was coined to indicate the learning process that is triggered when the behaviour of an individual, who acts as a model, influences the behaviour of the observer. Through this process, according to Wenger [2], individuals become integrated as group members into the community in which they live, work, study and collaborate.

Topping [3, 4] called *Peer Learning* or *Peer to Peer Learning* the interaction between peers that leads to learning and subject development. *Peer Learning* has taken on different names; in fact, Havnes, Christiansen, Bjørk and Hessevaagbakke [5] have associated the construct with a multitude of appellations including collaborative/cooperative learning;

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peer tutoring; group tutoring; additional education; peer-assisted learning; peer review; dialogic pedagogy; reciprocal teaching.

For many years now [6], specific literature has argued that peer interaction is qualitatively different from teacher-pupil interaction, and, like any educational strategy, it can have advantages and disadvantages [7]. Griffin B.W. and Griffin M.M. carried out two studies [8] to evaluate the effects of reciprocal peer tutoring on academic performance, anxiety associated with performance, and the perception of self-efficacy in students who had already graduated. Griffin B.W. and Griffin M.M. underline how, in the peer tutoring phase, both tutors and tutees acquire positive learning outcomes, and specifically they point out that the tutors benefit the most, as they are personally involved in the study of course contents, while they train to teach the tutees [9–12]. Starting from the benefits that tutors themselves draw from the position held, Fantuzzo and other colleagues in various analyses [13, 14] have tested a practice that allows all those involved in peer tutoring to act as tutors. The technique described above is called "Reciprocal Peer Tutoring" (RPT) and implies that students hold the position of both tutor and tutee. It has also been pointed out by the scholars who conducted these experiments that this dual role allows them to acquire deep knowledge, skills and abilities.

The literature in the field shows how peer tutoring contributes, making students co-leaders of the educational process by encouraging course attendance, the elaboration of an appropriate study method and the performance of the inherent educational activities [7].

2 The Research Context

The study and its results presented below are part of the post-graduate courses promoted by the Centre for Museum Studies (CDM) - Department of Education, University Roma Tre: the one-year post-graduate course in "Museum education" and the two-year post-graduate course in "Advanced Studies in Museum Education". The former is aimed at providing students with the theoretical foundations in the subject and at learning how to use tools to analyze museum visitors' characteristics and needs, the latter is addressed to those who are interested in deepening the museum education theoretical framework and wish to test educational research methods in the above context. Students are also trained in museum standards in education, according to the latest results of international research in the field. The course ensures an international dimension to all its activities through the participation of national and international lecturers, who are experts in museum education, new technologies applied to cultural heritage and its use, and innovative methodologies used in museum education.

Both the courses, organised in a blended mode, went through an emergency digital transformation process during the Covid-19 pandemic and they were completely reorganized: course contents were newly conceived and adapted to the current state of cultural heritage institutions, the e-learning platform was enhanced, specific OERs were designed and introduced and new modules and activities were realized in the e-learning mode [15], to overcome the restrictions imposed by the global health emergency.

In order to facilitate access to the course contents, an easier distribution of information, handing out frequent clarification messages on learning activities and classes,

was carried out, but above collaborative processes among students, starting from the academic year 2020/21, were enhanced and to this aim peer tutoring groups were set up. Six tutors were chosen among the students awarded scholarships and attending the second year of the biennial course. The choice of these type of students was twofold. First, according to the course regulations, under regular course conditions, they would have been asked to act as classroom tutors, and therefore assist the teachers and other students during the activities in the classroom and in the museum, a task that was not possible due to the health emergency. The second reason is related to the experience gained during their first year of attendance.

The above six tutors were trained at the beginning of the academic year, to ensure that they were fully prepared for the role assigned to them. They were, therefore, assigned subgroups made up of randomly selected students from the annual e and the biennial course. A mailing list drafted by the Tutors' Coordinator, supervised by a senior Tutor, put everyone in touch with the other. The Tutors' Coordinator had the task of managing any issue raised by the students, organizing monthly meetings for discussion and coordination, and forwarding to the Senior Tutor, the Scientific supervisor, and the Director of Courses those students' questions that tutors were unable to answer. The diagram below explains such an organization (Fig. 1).

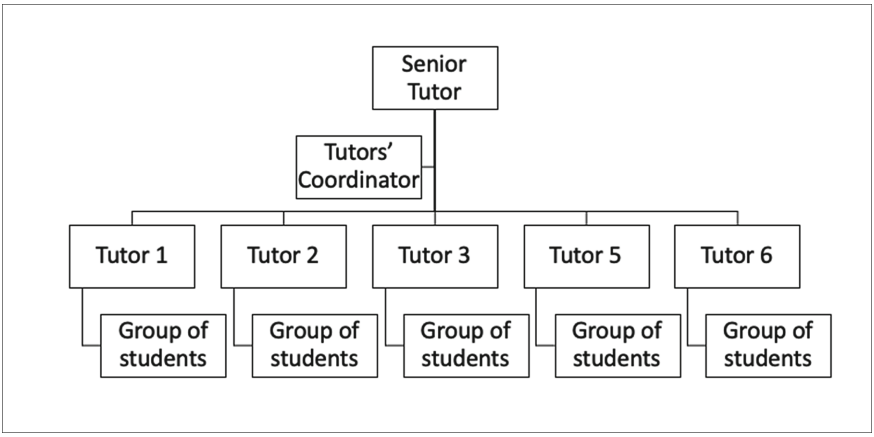

Fig. 1. Organization of peer tutoring activity in the post-graduate courses

3 Methods

Given the above framework, we decided to inquire the level of satisfaction perceived by the students with the peer tutoring they experienced, in a post pandemic dimension, and to highlight if and how self-assessment carried out by the tutors, regarding their role and the skills acquired during the course, played a role in community building and the development of soft and professional skills.

A pre- and post- self-assessment survey was filled in by the tutors at the beginning and at the end of the academic year 2020/21: the survey is composed by three main sections aimed at investigating tutors' initial and final perceptions regarding the fulfilment of specific tasks inherent to their role, together with the development of soft and professional skills. Moreover, a survey was submitted to the post-graduate students in order to investigate the real effectiveness of peer tutoring activity, giving them the opportunity to highlight strengths and weaknesses of the experience.

3.1 Participants

Six tutors, as mentioned above, attending the second year of the biennial post-graduate course took part in the activity; they are 36 years old on average and a background in Humanities, mainly in Arts, History and Archaeology.

As for the students, 27 participated both from the annual post-graduate course in "Museum education" and the biennial two-year post-graduate course in "Advanced studies in museum education", they are 34 years old on average, and with a background in Arts, History and Archeology.

4 Data Collection and Data Analysis

4.1 The Tutors' Self-assessment Questionnaire

The same self-assessment questionnaire was filled-in by the tutors at the beginning and at the end of the experience. After an initial part aimed at collecting general information on gender, age, education and geographical origin, the survey included three open-ended questions on motivations, expectations regarding the course and the role of the tutor.

- The first section, concerning the task-based self-assessment, collected the tutors' perception of their ability to assist the students on issues related to the theoretical teaching units, to the virtual platform where the teaching activities were held remotely, to the online lessons, to the procedures/information about the internship and the final post-graduate thesis.
- The second section was structured to investigate the level of perception regarding one's soft skills and competences, including communication, creativity, problem solving, collaboration and critical thinking, with the aim of monitoring any changes that occurred between the initial phase of the experience and the final one.
- The last section of the survey was devoted to the detection of the level of professional skills in the tutors' educational field. The questions concerned the ability to design educational modules to promote interculture skills, accessibility, and cultural heritage successful experiences; but also, to assess the above activities, workshops, research actions that put into practice the knowledge acquired during the course.

The questionnaire proposed to the tutors was entirely developed by the research group involved in the present study based on the specific tasks and skills being assessed.

The Students' Peer Tutoring Evaluation Survey

At the end of the post-graduate courses, the students evaluated the peer-tutoring experience by answering specific questions aimed at analysing the real impact of tutoring on

their learning path, together with the possibility of indicating strengths and weaknesses of the experience.

The students' peer tutoring evaluation survey is composed by 4 main sections:

- the first section presents questions aimed at finding out the personal, educational and background information of the students. It contains also three open-ended questions are aimed at recording the expectations in relation to the post-graduate's course attended and to tutoring in general.
- The second section is dedicated to the evaluation of peer-tutoring with multiple choice questions that could highlight the effectiveness of the technical and didactic support together with the rapidity and completeness of the answers received.
- The third section is devoted to students' self-assessment as far as study and learning methods are concerned, in order to link each student's style with tutoring opportunities.
- The questionnaire ends with two open-ended questions investigating the strengths and weaknesses of the experience and a space for suggestions for improvement.

The survey was based on a work by Paljug, B., & Lampe, L. [16] in which the authors focus on the analysis of university peer tutoring based on key measures of success: usage, satisfaction, effectiveness, and learning outcomes. In this study, Paljug B. & Lampe L. are interested in learning outcomes related to study skills and learning attitudes, specifically regarding deep versus surface learning. The tools they proposed were adapted to the characteristics of the post-graduate courses, to online tutoring, and to other peculiarities consistent with the proposed teaching activities. In particular, some indicators contained in the first section of Paljug B. & Lampe L.'s survey were readjusted according to the educational activities of post-graduate courses (Table1).

Table 1. Comparison of the Paljug B. & Lampe L. survey Part.1 with the Sect. 2 Students' peer tutoring evaluation survey.

Part 1. Usage, satisfaction, and effectiveness. Paljug, B., & Lampe, L. survey	Section 2. Students' peer tutoring evaluation survey
This semester, about how often have you used SEAS[1] tutoring?	This year, how many times have you used the tutoring programme?
My tutor(s) was /were skilled in the subject/course material	My tutor(s) was /were skilled in the subject/course material
My tutor(s) successfully answered my questions and helped me with my work 3	My tutor answered my questions in a satisfactory way and supported me appropriately
My tutor(s) improved my overall understanding of the subject/course material	My tutor improved my overall understanding of the course content

(*continued*)

[1] SEAS: School of Engineering and Applied Science.

Table 1. (*continued*)

Part 1. Usage, satisfaction, and effectiveness. Paljug, B., & Lampe, L. survey	Section 2. Students' peer tutoring evaluation survey
Tutoring sessions were convenient for my schedule. Strongly disagree (1); Disagree (2); No opinion (3); Agree (4); Strongly agree (5)	The use of new technologies and the platform used during the year facilitated communication with the tutor
In our sessions, I noticed that my tutor(s)…	Tutor support facilitated understanding and assistance with the *Fomonline* platform
My tutor(s) helped my study skills (e.g., test taking, time management, study habits)	The tutor's support helped me improving my ability to analyse and synthesise information, link and integrate information from different sources
It was easy to find information about SEAS tutoring	It was easy to get exhaustive answers from the tutor
The tutoring information I found was helpful	The information provided by the tutor was useful
Overall, how would you rate your experience with SEAS tutoring?	Overall, how would you rate your experience with the tutoring programme?

Part 2 of Paljug B. & Lampe L.'s survey "Deep versus surface learning approaches" was submitted to the students in the third section, except for questions (Table 2) as they were very specific to the course analysed in Paljug B. & Lampe L.'s study.

Table 2. Part 2 of Paljug B. & Lampe L.'s survey proposed in Sect. 3 of the student questionnaire.

Part. 2 Deep versus surface learning approaches questions All questions below used the response scale: Strongly disagree (1); Disagree (2); No opinion (3); Agree (4); Strongly Agree (5)
Any topic can be interesting once I get into it
My aim is to do well in class with minimal work
I test myself on important topics until I understand them
I focus my studying on what's in the course outline/syllabus
I seek out tutoring to help me understand important concepts and ideas
I come to classes with questions in mind that I want answered
I spend free time finding out more about interesting topics from class
I often discuss class material, concepts, and applications, with my tutors
I try to keep my time with tutors focused on my specific homework/assignments

5 The Tutors Self - Assessment Role

5.1 The Tutors' Self-assessment Survey

By comparing the results of the pre- and post- tutors' self-assessment survey and analysing the open-ended responses, motivations which prompted the tutors to undertake the post-graduate course appear to be the same at the beginning and at the end of the experience, driven by the desire to explore specific issues and to improve their professional skills.

Concerning the opinion on the tutor position linked to an incentive to a more active participation in the course activities, there is no significant increase between pre- and post- as, since the beginning of the second year, the tutors stated that the new position would encourage them to reach a more active participation and that it would represent a valid support for the course colleagues, an idea reconfirmed at the end of the experience where they expressed the same opinion.

Analysing the data from the self-evaluation based on the effectiveness of the support provided in relation to their tasks (Fig. 2), we note a slight decrease, excluding two items, in all activities falling within their role.

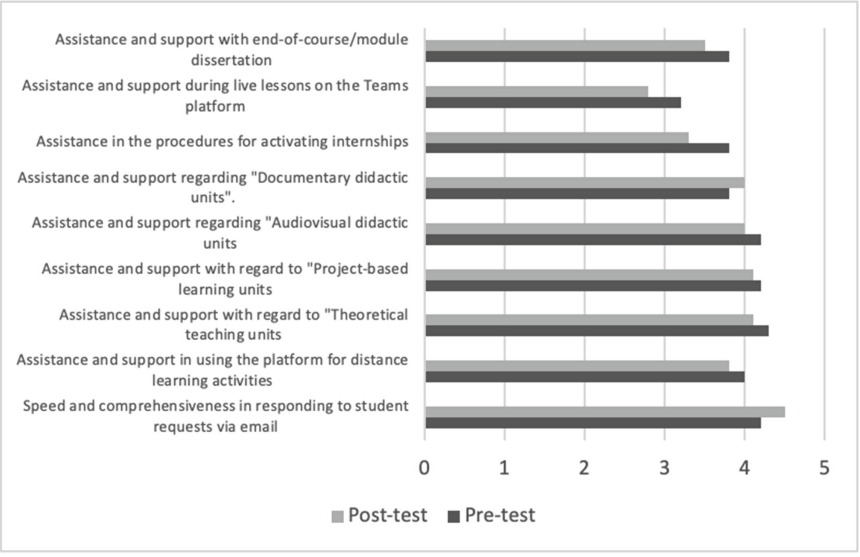

Fig. 2. Self-assessment based on tutors' tasks

The items that showed a slight increase between pre- and post-survey were the speed and thoroughness in answering emails and the assistance on the documentary teaching units. Of course, since the tutoring took place exclusively online and the communication between tutor and tutee took place only by e-mail or through groups on social networks, the increase seems entirely justified. The descriptor with the largest decrease, however, is that related to the procedures and activation of internships, motivated by the fact that

internship activation procedures require the mediation of expert tutors and other figures outside the course who act as intermediaries between the students, the university and the host institutions. Therefore, apart from reporting to the Tutors' Coordinator and to the Senior Tutor problems related to the platform on which accreditation for the internship is carried out, no other type of support fell within the tutor's remit; this could explain the decrease in internships.

Deepening the results related to the self-assessment of soft skills (Fig. 3), the overall trend does not seem to have undergone a significant variation between pre and post-test. It is possible to notice, however, some competences that were perceived to be more implemented than others. These include management skills, collaboration skills and problem-solving skills.

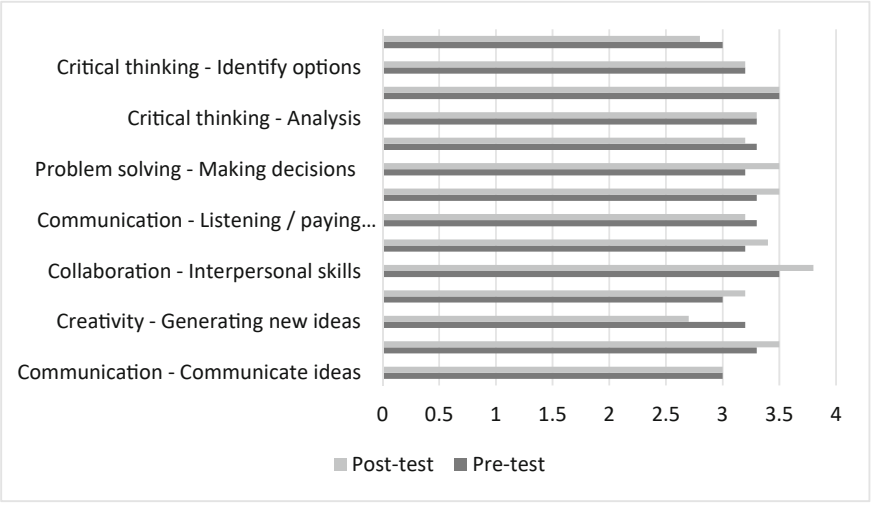

Fig. 3. Soft skills self-assessment

The creativity competence and the ability to generate new ideas, images or drawings and find innovative solutions to problems appears to be the least solicited, most probably because the tutors were asked to adhere to the instructions received during the training and in the course regulations.

The most encouraging and positive results are to be found in the increase of professional skills in the educational-didactical field recorded by the tutors. All the skills indicated showed an increase, as can be deduced from Fig. 4, except for the ability to create functional materials for educational interventions which remained constant.

The same promising results were found in the self-assessment of the level of competence perceived of the tutors contained in the last section of the survey that was devoted to the detection of the level of professional skills in the educational field. All the areas of activity including carrying out research and study activities for the purpose of heritage mediation, designing educational interventions, designing research and didactic activities in teams, identifying the theoretical framework, the objectives, the tools, and

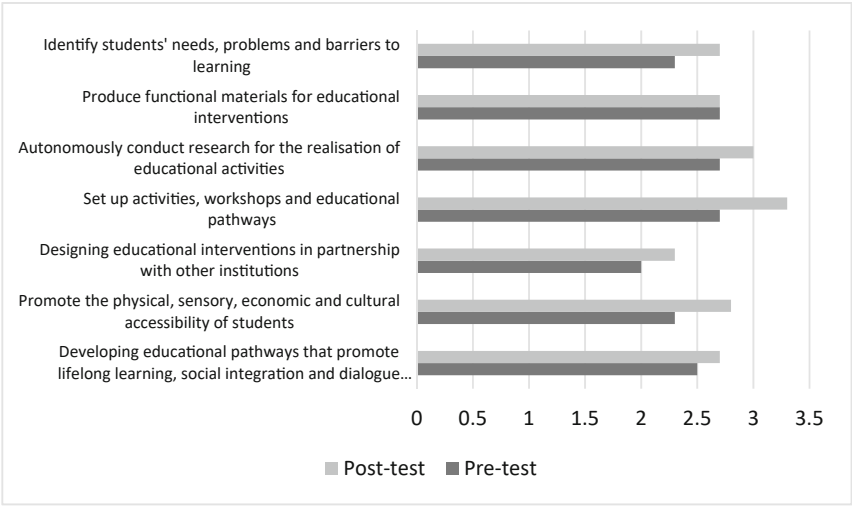

Fig. 4. Self-assessment of your own professional skills (educational field)

the methodology of a didactic pathway showed a good increase compared to the levels perceived at the start.

5.2 The Students' Peer Tutoring Evaluation Survey

27 students assessed online peer-tutoring that took place throughout the academic year. The motivation for most of the students to attend the post-graduate courses was to deepen their knowledge in museum education, education, and modern methodologies, and to enhance their professional skills. All respondents also stated that the course met their expectations, with only one student stating that the expectations were only partially met. 18 students rated the tutor's support positively, 3 students did not benefit from the support of colleagues, while 4 judged the peer-tutoring not to have met their expectations. Regarding the frequency (Fig. 5) with which the students relied on their tutor, 17 used the support less than once a month, 8 one to two times a month and 2 three to four times a month.

Concerning the preparation on the course subjects, the completeness of the answers provided and their usefulness, 19 students expressed a completely positive opinion, 3 were moderately satisfied and 5 were not fully satisfied with the tutoring. 18 students stated that the use of new technologies and the platform used during the year facilitated communication with the tutor, 6 expressed neither a positive nor a negative opinion, while 3 evaluated negatively the technological tool used as a communication medium. Analysing the answers related to the improvement of critical thinking skills thanks to their tutor's support, 12 students expressed a positive opinion, 10 were uncertain and 5 did not state any improvement (Fig. 6).

About the overall judgement on the tutoring, 21 participants evaluated the experience as positive overall, 3 expressed an uncertain opinion and 3 considered it as negative.

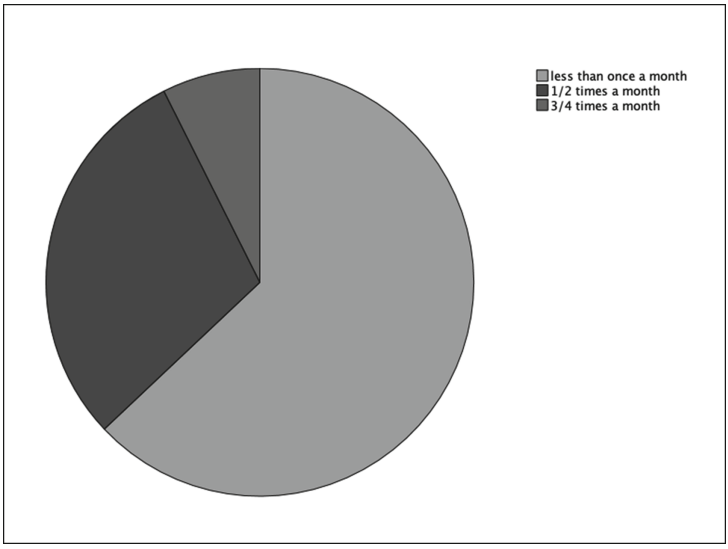

Fig. 5. This year, how many times have you used the tutoring programme?

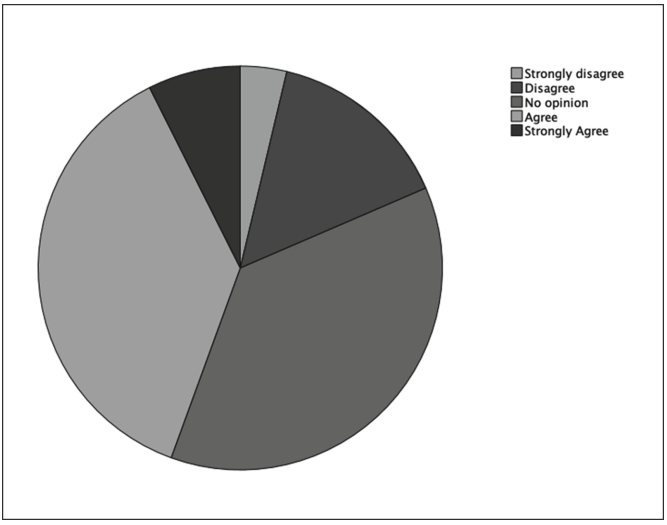

Fig. 6. The tutor's support helped you improve your ability to analyse and synthesise indications, link and integrate information from different sources.

Moving on to examine the self-assessments expressed regarding their own study and learning styles, 24 of respondents stated that all topics discussed during the course had engaged and interested them fully while 3 took an uncertain position in this regard.

In addition, most of the students stated that they spent time studying the topics covered during the course until they had completely understood them (21 out of 27 students).

8 students stated that they prepare before class by formulating some questions to ask the lecturer, while 11 did not use this method and 8 expressed uncertainties about it. From the questions concerning the correlation between study and the questioning-deepening of their understanding of the contents of the course and requesting clarifications from the tutor it emerges that 21 students prefer not to rely on the tutor and therefore study autonomously, 3 students did not express a decisive position, while 3 stated that they exchange opinions on certain course topics with their colleagues. 23 students stated that in their free time they look for further information on interesting topics discussed in the lessons, 3 stated an uncertain opinion, while 1 do not use their free time to study the contents in depth (Fig. 7).

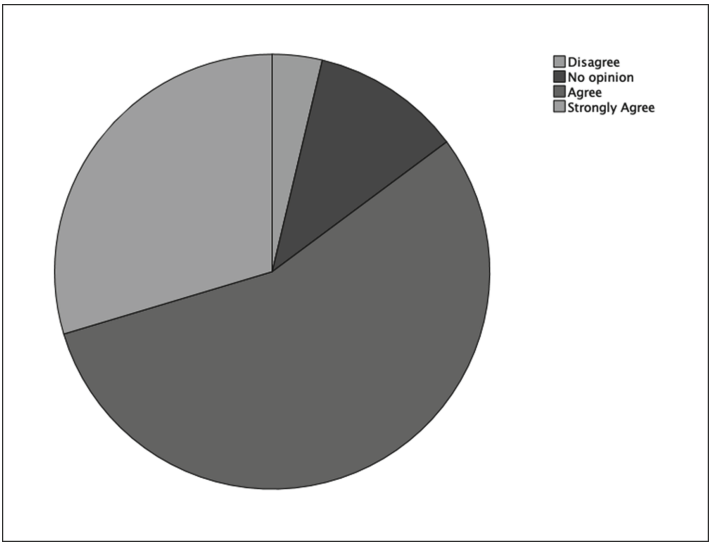

Fig. 7. In my free time, I look for more information on interesting topics covered in class.

The survey ends with two open-ended questions aimed at finding out the students' opinions on the strengths and weaknesses of their experience with the tutor and suggestions for improving the support offered. There are many positive aspects highlighted by the students compared to the negative ones. Among the positive ones, the following are to be mentioned: the speed and completeness of the answers, the use of social media groups to quickly compare notes, the constant presence, the availability, and the role of tutors as a link with the teachers and the other members of the course, the provision of positive suggestions on the articulation of the assignments and work assigned to them by the various teachers. The weaknesses detected, as above specified, were not many; those highlighted by some concern the lack of personal initiative in relation to the opportunities for group discussion or in-depth study of specific issues and the occasional lack of preparation on certain aspects concerning the rules and procedures (Fig. 8).

The suggestions made by the students certainly represent a valuable source of information to refer to in relation to the new academic year and the establishment of new

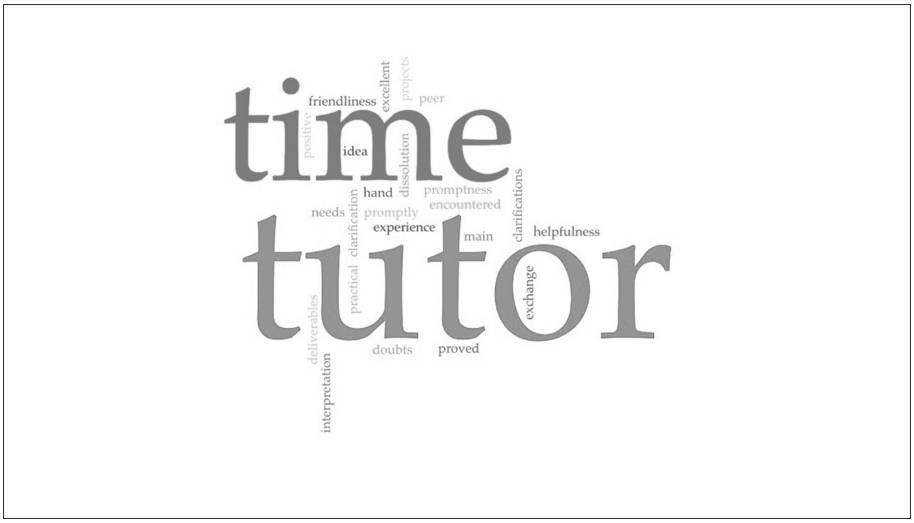

Fig. 8. Word-cloud of the given answers related to the strengths of peer tutoring experience

tutors; among the most frequent suggestions, there was a need for greater interaction between the tutor and the small group of students they are responsible for, the need for more opportunities for group tutoring, more discussion and in-depth study groups on issues addressed during lessons and teaching activities, a video presentation of the tutor to be shared on the platform used for online activities and a proposal to value ECTS for tutors to encourage them to perform their assigned role even better.

Among correlation analyses of the questionnaire results, "knowledge of contents" and "tutors' ability to give satisfying feedback and adequate support" seem to be statistically significant ($r = ,896$ $p = < 0,001$). This confirms that tutors training is pivotal for peer tutoring success. "Knowledge of contents" appears to be correlated also to perceived usefulness of feedback over the tutoring service ($r = ,848$ $p = < 0,001$). Last but not least, another meaningful piece of data seems to be that related to students' digital skills. They helped communication with the tutors facilitating general understanding of course contents ($r = ,538$ $p = 0,004$).

6 Conclusions

In their 2014 paper, Delahunty and colleagues [17] illustrate the dynamics that are triggered in a classroom, albeit a virtual one, between students who come together to learn through dialogic, often asynchronous, exchanges. This creates distinctive learning environments in which learning objectives, interpersonal relationships and emotions are no less important due to their 'virtuality', and to which traditional F2F methodologies are not easily superimposed. The above-mentioned research reveals consistent connections between interaction and sense of community, highlighting how the strong sense of identity and collectivity, which is also established during online courses, is little explored in studies in the sector.

The results of the peer tutoring analysed in this paper shows that the aspects considered most positive by the students included the idea that peer tutoring created group bonds and increased the sense of "community", albeit virtual, as well as providing information and support to the students. The data, which cannot be generalized, shows that peer tutoring, experienced for the first time in the context described above, was seen as a positive, profitable and useful experience for the achievement of the course objectives. The positive feedback is registered both in the self-assessments made by the tutors and in students who availed themselves of the support of their colleagues. Suggestions for improvement will certainly be taken into consideration in order to make improvements to the service offered, including more opportunities for group discussion, differentiated channels for exchanging ideas and in-depth analysis of topics covered in the lessons.

Certainly, the positive results illustrated demonstrate the usefulness of online peer-tutoring and encourage further study in the coming years, including the introduction of further tutoring methodologies to test their effectiveness in the specific context and, hopefully, also investigate aspects linked to the socio-emotional and relational sphere pertaining to both tutors and students.

Authors' Statement

The authors of the present paper contributed to the writing of this article as follows: A. Poce (1. Introduction, 2. Research Context and Conclusions), M. R. Re (3. Methods), M. Valente (4. The Tutors Self-Assessment Role).

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Exploring Study Futures: The Future of Higher Education from a Student Perspective

Laura Eigbrecht(✉) and Ulf-Daniel Ehlers

DHBW Karlsruhe, Baden-Wuerttemberg Cooperative State University, 76133 Karlsruhe, Germany
{laura.eigbrecht,ulf-daniel.ehlers}@dhbw-karlsruhe.de

Abstract. While the almost complete conversion of university teaching to digital formats in March 2020 initially had a disruptive effect, in the meantime almost all university teachers and learners can look back on numerous experiences with different forms of university learning and teaching. These experiences can contribute to the design of higher education teaching and learning of the future. The article describes an explorative analysis that asks from the students' point of view which studies from Germany can be identified that give hints and statements about the future of studying from the students' point of view and what wishes, requirements, preferences are articulated for future higher education teaching. For this purpose, this article collects evidence from studies on higher education teaching and learning of the future and presents the inductively formed category system as the first result of a structuring content analysis, which gives first indications of significant topics, statements and preferences.

Keywords: Future of higher education · Digitization · Covid-19 · Qualitative content analysis

1 Introduction

"Universities have now shown that they can make rapid changes. And when the university leaders (…) tell me next time that sustainable development and interdisciplinarity don't work because the university is a slow, big tanker, then I will reply that it does work and that they just don't want it to. Then they have to explain to me why they don't want it – and I look forward to that discourse." (Jorin Meyer, Studium in Shutdown, Episode 5).[1]

In the third year since the beginning of the pandemic, it has become clear that, starting from the "new normal" of university teaching, a state of constant adaptation has developed between pandemic events, classroom teaching and digital teaching – and numerous hybrid forms. While the almost complete conversion of university teaching to digital formats in March 2020 initially had a disruptive effect and was seen as a field attempt to rethink university teaching (Dittler and Kreidl 2021), in the meantime

[1] https://anchor.fm/studium-im-shutdown/episodes/Folge-5---Jorin-ed458d/a-a20h0pr.

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almost all university teachers and learners can look back on numerous experiences or even routines with different forms of university learning and teaching. In a qualitative evaluation of interviews with students during the pandemic, Ehlers and Eigbrecht (2021) stated that students have become more aware of different forms of teaching and learning and corresponding quality and learning preferences, and that it is important to include these experiences, ideas and wishes in the design of future higher education teaching and learning.

2 State of Research and Research Question

Numerous studies describe the experiences made with higher education teaching and learning in times of the pandemic from the perspective of various stakeholders such as higher education teachers (e.g. Malewski et al. 2021), higher education leaders (e.g. Bosse et al. 2020) and students (e.g. Preböck and Annen 2021), especially in the first "corona semester," the summer semester of 2020. At that time, these were conducted and evaluated primarily within universities and quantitatively, but also across universities (e.g. Karapanos et al. 2021) and qualitatively (e.g. Gabriel and Pecher 2021). Studies from a student perspective reveal differences and perceptions of how studying works well and less well, and also suggest desires, preferences, and ideas for the future of higher education. While the first semester can still be considered a field trial and in most cases was largely conducted exclusively digitally, the variety of teaching modes in subsequent semesters is great, while at the time of writing the fifth semester since the beginning of the pandemic is imminent. This means that university teaching continues to take place under the sign of the pandemic and hygiene regulations and requirements, but in contrast to the summer semester 2020, it can build on numerous experiences and reflections made – which need to be analyzed and processed. Studying under the sign of a pandemic can now be described as the "new normal".

Thus, university teaching and learning no longer takes place only in a disruptive emergency mode, so that students' statements – according to the underlying assumption of the following analysis – take place in a more reflective way and do not only refer to coping with the current everyday study routine. Thus, based on multiple experiences with different forms of teaching and learning, even students who started their studies during the pandemic can also increasingly formulate preferences and requirements for university teaching in the future and articulate subjective quality preferences (Ehlers 2004). In this approach, students are seen as experts for good university teaching and learning, who shape and reflect on their own learning processes and thus can help shape the future of studying from a subject perspective according to the subject-scientific learning theory (Holzkamp 1993) – and should be included in future higher education design processes.

For this purpose, this paper describes a qualitative explorative analysis of published studies in Germany after the summer semester 2020, which are analyzed for thematic indications of preferences and evaluations of future higher education. Statements about experiences and corresponding wishes and preferences are thus analyzed and used to further develop university teaching and learning in a sustainable way and thus to be able to use the potentials of different forms of teaching and learning. This exploratory

analysis is carried out across all universities and asks: Which studies can be identified that provide information and statements on the future of higher education teaching and learning from the students' point of view? What wishes, requirements, preferences are articulated for future higher education?

3 Research Design

For the planned explorative structuring content analysis, it is first necessary to create a corpus of studies that is as comprehensive as possible, which is to be evaluated. This corpus already represents a relevant research output. It has been decided to only focus on one national educational context, in this case Germany, to allow at least for partial comparability of studies. The reason for this is the variety of national policy reactions to the pandemic situation affecting not only, but also the (higher) education sector.

For this purpose, a keyword-based online research was conducted and supplemented by the analysis of various study overviews on "corona higher education" in order to identify relevant studies. The search terms and the added study overviews are shown below (Table 1):

Table 1. Search terms and resources.

Search terms:
hochschule studie corona 21 + 22
universität studie corona 21 + 22
studieren studie corona 21 + 22
hochschule befragung corona 21 + 22 (6 pages results included because of the amount of results)
universität befragung corona 21 + 22
studieren befragung corona 21 + 22 (7 pages results included because of the amount of results)
hochschule umfrage corona 21 + 22
universität umfrage corona 21 + 22
universität umfrage corona 21 + 22
Google + Google Scholar research, 17 & 18/03/22; inclusion of the first three pages of results, unless otherwise stated
Study collections and overviews:
https://padlet.com/HDS_Zentrum_Leipzig/vnify31nppydz75xPadlet: "Forschung rundum Lehren & Lernen in Zeiten von Corona"
https://airtable.com/shrQFS0CG3jdPf725/tblbgmyj6f8HAiKYo Corona in Education Study Overview
https://www.konsortswd.de/ratswd/themen/corona/studien/ Studien zur Corona-Pandemie
https://www.medienpaed.com/issue/view/91 Medienpädagogik issue 40: CoViD-19 und die digitale Hochschulbildung. Irritationen, Einsichten und Programmatiken

For this purpose, the following criteria were formulated according to the research question, which must be fulfilled in order to include the study in the analysis corpus:

- Studies after the summer semester 2020 or beyond in the case of multiple surveys.
- Studies from the student perspective, qualitatively and/or quantitatively conducted and analysed
- Statements on university teaching of the future: include statements from which conclusions can be drawn beyond the pandemic with regard to study preferences
- Report/article freely accessible online
- Survey already completed and results published
- HEIs in Germany to enable comparability with regard to the educational context

Accordingly, studies were not included in the evaluation for the following reasons:

- Study was in German language, but in a different higher education context (Switzerland, Austria)
- no future-relevant information/statements/items
- ongoing survey; no results published yet
- Student perspective cannot be analysed separately
- Results not publicly available
- Document not available at the time of evaluation

For the evaluation, the content structuring qualitative content analysis according to Kuckartz (2018) is chosen, which allows a flexible approach with different types of data even in the explorative research stage. Since the aim is to identify thematic areas, an inductive approach to the material is chosen. This way, a thematic state of research is to be drawn from the point of view of students' statements on higher education teaching and learning of the future.

Furthermore, own analyses of a qualitative interview study with students, published as podcast series "Studium im Shutdown" and "NextNormal" and already described in various publications (cf. Ehlers and Eigbrecht 2021), are included. It should be mentioned here that these data were not collected exclusively in the German educational context.

Limitations of the described approach are the restriction to two search tools of the provider Google as well as the keyword-based approach, which potentially bears the risk of not identifying all relevant studies. By adding the evaluation of various study reviews, an attempt was made to partially counteract this.

Based on the criteria formulated in advance, the following studies were included in the analysis (Table 2):

Table 2. Overview of included studies.

Name	Institution	Cross-institutional	internal	WS 20/21	SS 21	WS 21/22	quantit.	qualit.	Mixed Meth.
1. Studium und Lehre in Zeiten der Corona-Pandemie – Die Sicht von Studierenden und Lehrenden	CHE	x		x			x		
2. Entwicklungspfade für Hochschule und Lehre nach der Corona-Pandemie	u.a. Institut für Bildungstransfer der Hochschule Biberach	x		x				x	
3. Studieren unter Corona-Bedingungen	Uni Mannheim		x	x			x		
4. Erstsemesterumfrage WiSe 20/21	TU Berlin		x	x			x		
5. Corona-Bilanz. Studieren. Lehren. Prüfen. Verändern. Studie an den bayerischen Hochschulen für angewandte Wissenschaften	Forschungs- und Innovationslabors Digitale Lehre – FIDL	x			x				x
6. Stu.diCo II – Die Corona Pandemie aus der Perspektive von Studierenden	Uni Hildesheim & Uni Münster, bundesweit	x			x		x		
7. Studium als sozialer Raum. Ein Schreibgespräch zwischen Studierenden und Lehrenden	Lohner, Mozer & Schmid-Walz (KIT)		x		x			x	
8. Informatik, Mathematik, Physik – Studienbedingungen an Deutschen Hochschulen im zweiten Jahr der Corona-Pandemie	CHE	x			x		x		
9. Stuvus-Umfrage zur digitalen Lehre im Sommersemester 2021	Uni Stuttgart		x		x		x		
10. Corona Umfrage WiSe 21/22 unter Studierenden vom fzs e.V	fzs e.V	x				x	x		
11. Studierendenbefragung zum Wintersemester 2021/22	Uni Regensburg		x			x	x		

(*continued*)

Table 2. (*continued*)

Name	Institution	Cross-institutional	internal	WS 20/21	SS 21	WS 21/22	quantit.	qualit.	Mixed Meth.
12. Dritte PotsBlitz-Befragung zum Wintersemester 2021/22	Uni Potsdam		x			x	x		
13. Rekonstruktion subjektiver Studienerfahrungen im ‹Shutdown› der Corona-Pandemie (also international context, thus only exemplary evidence)	*Ehlers & Eigbrecht*	*x*		*x*				*x*	
Total	13	7	6	5	5	3	19	3	1

Among the 13 studies included in the analysis, there are similar proportions of internal and cross-institutional studies. Five of these studies were conducted in the winter semester 20/21, five in the summer semester 21 and three in the winter semester 21/22. It can be assumed that several studies are still being evaluated and that the present analysis can only represent an interim status. The majority of the studies were conducted using quantitative methods (online surveys); three studies were qualitative and one study used mixed methods.

4 First Results of the Qualitative Content Analysis

For the content analysis, those passages were identified in the material that make statements about the future of higher education. It can be stated that such passages occupy only little space in the majority of the analyzed documents. Thematic categories were then inductively formed on the basis of the text and a category system was drafted in order to identify topics that concern the university of the future from the students' point of view. From this, the presented category system (Table 3) was created in a multi-step processing of the material, which represents a first result of the content analysis. From the students' point of view, it thematically traces those statements that were made in the included studies on future higher education.

This category system is only the first step of the analysis. A detailed analysis must also differentiate according to survey methodology, sample and type of data (direct quotations as opposed to summarized statements by the authors) as well as put the analyzed text passages in relation to each other. Furthermore, it can be assumed that further studies that could be relevant for the analysis (e.g. STECCO[2]) are still being evaluated and have not yet been published. However, further analysis can now build on the category system that has been created.

[2] https://www.dipf.de/de/forschung/aktuelle-projekte/stecco-start-in-die-tertiaere-bildung-waehrend-der-corona-krise-chancen-und-herausforderungen.

Table 3. Category System.

List of categories	
Values & wishes University of the Future	**Didactic Model University of the Future**
Framework conditions	**Further development of traditional higher education teaching and learning**
Participation	Accessibility
Solidarity and support	Flexible time management
More inclusive teaching and social opening	No compulsory attendance
Transparent communication	Considering social spaces for living and learning
Expansion of existing support services	Digital office hours
Governance	Variety of teaching and learning formats
Institutions shall maintain flexibility and willingness to change	Extracurricular events with external guests
Put the topic of sustainability on the agenda	**Primacy online**
Teaching and Learning	Clear preference online classes
Consider individual student needs	Online exams
Involve students in the design of teaching and learning	**Primacy face-to-face & online**
Quality of education – keep the conversation going	Combination of digital and face-to-face formats
Openness to new things	Maintain digital formats
More practice, less theory	Use of interactive/digital tools
Didactical further development	Online classes as additional formats – digital support
Challenges face-to-face teaching and learning	Lecture recording
Fear of many social contacts	Digital theory lectures
Potentials face-to-face teaching and learning	Hybrid teaching and learning
Work-Life-Balance; separation work and life	Flipped Classroom
Practical experience	Format decided according to quality of teaching and learning
Motivation through social encounter	**Primacy face-to-face**
Better exchange with teachers	Clear preference face-to-face formats
Potentials digital teaching and learning	

(*continued*)

Table 3. (*continued*)

List of categories	
Better digital availability of teachers	
Better use of LMS	
Promoting independence	
Time-saving	
Increased flexibility	
Learning according to own learning type and pace	
Time flexibility	
Spatial flexibility	
Regarding health	
Regarding mental health	
Regarding work	
Regarding care responsibilities	
Challenges digital teaching and learning	
Higher workload	
Lack of social exchange	
Discussion impeded	
Information missed	
Technical challenges	
Personal development more difficult online	

Nevertheless, the evaluation already permits initial analyses by main categories. **Values and wishes** that concern the university of the future relate to framework conditions for studying, whereby aspects such as participation, inclusion and transparency should be given even greater consideration in the future. Flexibility and willingness to change should also be maintained at the governance level, while topics such as sustainability should be addressed more thoroughly. With regard to teaching and learning, students articulate, among other things, a need to be involved in the design and to take individual needs into account. For **face-to-face or classroom teaching and learning**, potentials are formulated above all in the social and practice-oriented areas, while those of **digital teaching and learning** are seen in particular in the flexibility in various aspects as well as the promotion of one's own independence. However, challenges are also formulated that partly correspond to the potential of face-to-face teaching, but also address a higher workload, technical challenges, and a lack of information. The **didactic model for the university of the future** is only described in a few cases as being based purely on classroom or digital teaching. Rather, many studies call for the further development of traditional university teaching and for the advantages of digital formats to be considered.

Digital formats can completely replace single purely theory-based lectures, but in most statements they are seen more as a way of digitally supporting classroom teaching and thus offering more flexibility and more inclusive solutions.

In summary, the following can already be stated:

- Students articulate differentiated wishes and values for the university of the future with regard to framework conditions, governance, teaching and learning.
- Numerous potentials and challenges of classroom and digital teaching and learning are articulated.
- For the future of studying, it is important to combine classroom teaching and learning and digital forms in order to complement face-to-face teaching, to optimize it, and to make it more flexible and inclusive.

5 Conclusion

Due to the special pandemic-related study situation, students have become familiar with different ways of studying during the pandemic. By becoming more aware of what constitutes good teaching and learning for them, they perceive individual quality dimensions and requirements and thus also strengths and challenges of different study settings, such as the flexibility of digital formats and at the same time the limited possibilities of digital social interaction. Universities can use this awareness and benefit from student perspectives to jointly design future-proof higher education, involve students as experts for good university teaching and learning, and thus sustainably build on the experiences jointly made – in order to shape the future of studying. This article compiles studies on the future of higher education and presents the inductively formed category system as the first result of a structuring content analysis, which provides initial indications of significant topics, statements and preferences.

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Lessons Learned from 6 Years of a Remote Programming Challenge Activity with Automatic Supervision

Géraldine Brieven(✉), Simon Liénardy, and Benoit Donnet(✉)

Université de Liège, Institut Montefiore Liège, Liège, Belgique
{gbrieven,benoit.donnet}@uliege.be

Abstract. In an "Introduction to Programming" course dedicated to first-year students, many students tend to procrastinate and do not autonomously process step by step new topics taught over time. In response to that trend, a tool (called Café) was implemented to supervise a remote activity spread over the semester, by instantaneously correcting students' exercises and providing feedback to guide them in refining their solutions. This paper presents and discusses the current impact of the system on students' learning, based on six years of activity. The results validate the high potential of such a tool, but also highlight many students do not take advantage of that opportunity to boost their learning. That opens doors to some significant upgrades in the tool, mainly consisting in offering a closer guidance to students through a larger range of regular activities. While Café was initially standing as an isolated tool offering correction and feedbacks, this paper advocates for Café becoming an integral part of the course, leading to a consistent synergy between in-person and continuous remote learning.

Keywords: Blended learning · Remote activity · Correction and feedback automation · Students self-regulation

1 Introduction

For first-year students, Higher Education is a new ground with higher requirements and more freedom compared to Secondary School. To support their learning, they need to self-regulate [20], as their success heavily relies on their ability to autonomously and actively engage in their learning process [19]. In particular, in our "Introduction to Programming" course, it is essential to stay on track over the semester as the topics are cumulative. However, in practice, many students have difficulties in managing the amount of time and quality of cognitive effort devoted to learning [4,11].

From a context point of view, our country (i.e., Belgium) applies an open policy access to Higher Education. It results in large groups of first year students for which traditional classroom activities are organized. Moreover, students are fully free to take part (or not) in the academic activities, their only commitment

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being passing the final exam. Therefore, during the semester itself, we need to promote regular students' training, handling the diversity and the large number of students, for a limited number of supervisors.

With this purpose in mind, six years ago, we developed a remote regular activity, the Programming Challenge Activity (Pca). The activity spans over the whole semester and is made up of six programming Challenges targeting to punctuate students' learning by providing short-time goals. For supporting the Pca, we implemented a tool aiming to remotely guide students' learning while maintaining supervisors' workload feasible. More specifically, that tool, called Café ("Correction Automatique et Feedback pour les Ëtudiants" [9]) corrects students' work and provides instantaneous personalized feedback and feedforward, based on their mistakes, encouraging reflection and self-regulation [3]. That new approach was the first step towards Blended Learning, combining face-to-face and computer-mediated instruction.

Overall, from the six last years, we see that our current remote system does involve some students in their learning while some others do not take it as an opportunity to learn. We also notice that despite that some students took part in this remote activity, they still demonstrate a deep lack of knowledge and skills during the final exam. In response to those main observations, we intend to refine our system in accordance with students' actual needs.

To put in place those enhancements, we take a step back and bring the light on both strengths and weaknesses of the current version of Café in the context of the Pca. More specifically, in this paper, we closely analyze students' participation to the remote activity over the semester. Then, we examine how students interact with the tool as well as how it impacts their learning. More precisely, we are interested in how students self-regulate to perform the Challenges with that automatic supervision and how their self-regulatory skills are related to their performance. In the context of this paper, we restrict ourselves to students' time management to represent those self-regulatory skills. Finally, from our study, we identify the features of success that should be integrated in Café in the future in order to onboard more students over all the semester and further boost students' learning.

2 Context

2.1 The Course

Café was introduced in the context of the course "Introduction to Programming" (abbreviated here in "CS1"), provided to first year students (Bachelor level). It is organized during the first semester of the academic year with exams in January, preceded by a 15-day study period. The CS1 course consists of theoretical lectures (ten sessions), practical sessions (exercises on paper - ten sessions), laboratory sessions (exercises in front of a computer - five sessions). Lessons and exercises sessions typically last two hours.

Over the semester, maintaining students on track is essential as the topics taught in previous sessions are often prerequisites of the new coming ones. Under that concern, we boost student engagement by building the course around Assessment for Learning (AfL) [10,13]. In practice, a Mid-Term evaluation is organized during the first week of November for all courses of the semester [10] and six Programming Challenges are given over the semester, as illustrated in Fig. 1.

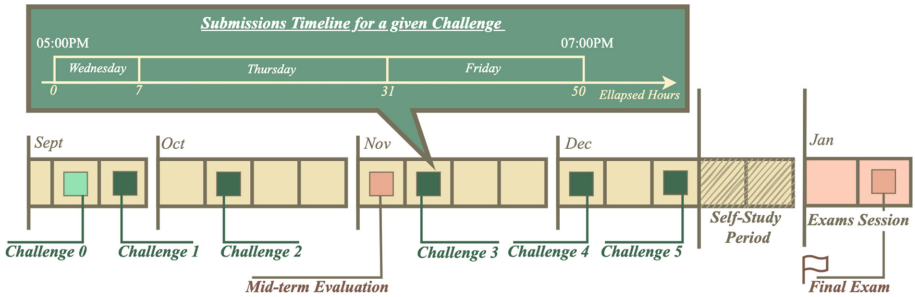

Fig. 1. CS1 course timeline, highlighting the Challenges as well as their general timeframe.

2.2 The Programming Challenge Activity (PCA) Supported by CAFÉ

The PCA is made up of six Challenges. Regarding the content, a Challenge is a statement aligned to the chapter taught the week(s) before. Like the chapters, Challenges are cumulative, requiring a good level of understanding about the previous topics to be properly handled. Each Challenge consists in producing some pieces of code. For Challenges 2, 3 and 4, students must also provide some graphical reasoning by filling a given canvas.

Regarding the modalities, each Challenge from 1 to 5 represents 2% of the students' final mark while the first Challenge ("Challenge 0") just gives the opportunity to get used to the system. Students get 2 days to individually perform the Challenge. As depicted in Fig. 1, each Challenge is published on Wednesday 17:00 and submissions are allowed until Friday 19:00.

Students get three submission shots per Challenge, where the last attempt is considered in the final grade.

As shown in Fig. 2, each submission is instantaneously processed by CAFÉ that computes, highlights what should be adapted in the current submission (through the feedback), and provides pointers to the theoretical courses (through the feedforward). In this way, students get the opportunity to realize their misunderstanding and improve their subsequent submissions. Figure 2 also highlights that, as supervisors, in addition to be timesaving and scalable, such a system

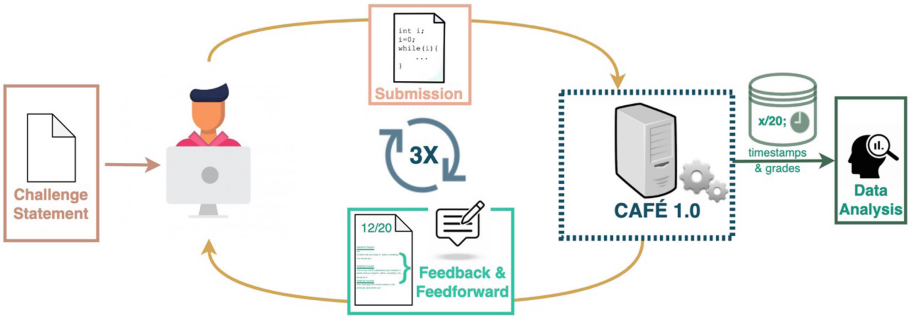

Fig. 2. Students' interaction with Café in the context of the Pca.

allows us to keep track of student's behavior by collecting data related to their activity and performance.

3 Method

3.1 Data Sources

Data was collected over the six last years (from 2016 to 2021) according to the 3 P's framework [18] that recommends to consistently analyze any pedagogical innovation by gathering and meshing three types of data reflecting dimensions of students' learning experience therewith: Participation, Perception, and Performance data.

3.2 Participation Data

In this paper, Participation Data reflects (if and) how students interact with Café, in the context of the Pca. More precisely, for each Challenge, we recorded each student's submission timestamp. From that timestamp, we can also easily derive the elapsed time between the moment the Challenge statement was published and the student's first submission (e.g., A student submitted their work on Thursday at 16:20 while the current Challenge was published on Wednesday at 17:00. The corresponding elapsed time is about 23 h). In Sect. 4, the "elapsed hours" unit is used to represent the submission slot time.

3.3 Perception Data

For academic year 2021–2022, an anonymous survey was administered to students at the end of their exam. 71 students shared their opinion. The survey was made up of Likert scale questions, asking about their experience with Café in the context of the Pca.

Notice that for the previous year, a survey was also addressed to students, but it was not mandatory and sent after the exam (i.e., during the second semester), leading to few answers and an overrepresentation of opinions from students who were involved in the course. Because of that bias, those answers were not included in our analysis.

3.4 Performance Data

All the grades every student obtained for the different Challenges were recorded. Moreover, we are also interested in the mid-term and the exam grades, considering that they model at best how much students learnt from the course at a given point in time.

4 Results and Discussion

In this section, the goal is to assess the current version of Café through students' experience over the Pca. To lead our analysis, we first identify how much students use Café by taking part in the Pca (Sect. 4.1) and how much it impacts on students' success (Sect. 4.2). Then, we deepen our research by studying how students use the tool (Sect. 4.3) and how that learning behavior is related to their performance (Sect. 4.4).

4.1 How Students' Participation Evolves over Time?

From Fig. 3, we can see that the participation varies quite similarly over the semester, from 2017 to 2021. Besides this, 2016 stands apart. Despite a participation decrease from Challenge 2 to Challenge 5 also occurred that year, we can notice that this reduction was slighter compared to the next years and the global participation remained quite high. When investigating deeper, we could note that in 2016, students outperformed in general, whatever the courses, compared to the other years.

Besides this, Fig. 3 depicts that, for each Challenge, there are always students who do not take part in it. Taking a closer look, we computed that 7% of students never participated to any Challenge. The possible explanations are that the Pca supported by Café is not attractive enough and/or the level of the Challenges is not adapted to some students. Another aspect to consider is that some students attend the course for a second time, meaning that they are already familiar with the course and may directly choose to handle it in their own way. Next to this,

Table 1. Number of students enrolled to the course from 2016 to 2021.

Year	2016	2017	2018	2019	2020	2021	Total
#Students	54	72	76	82	91	87	462

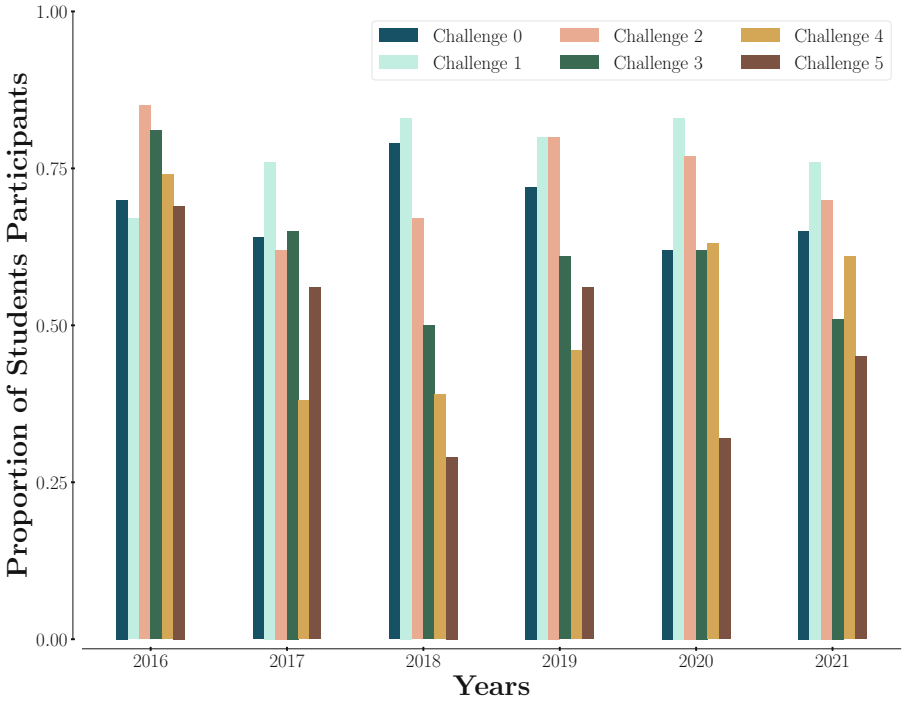

Fig. 3. Evolution of the proportions of students taking part in the Challenges from 2016 to 2021. See Table 1 for the raw number of students per year.

we computed that 43% of students participated to less than five Challenges, in accordance with Fig. 3 showing fewer participants in the last Challenges.

More precisely, the participation is the highest for Challenges 1 or 2, reaching a range between 77% and 85%. Participation to Challenge 0 is lower (despite its easiness to manage), probably due to the fact it does not contribute to the final grade. That suggests that some students' work is driven by grades. To go further, we can observe that, every year, participation drops across the last four Challenges and falls to a range between 29% and 46% (2016 being put apart). More specifically, from 2018 to 2021, we can notice a recurrent significant decrease (by 20%) from Challenge 2 to Challenge 3. We can relate it to Mid-Term organized between those two Challenges (as depicted through the timeline in Fig. 1). Indeed, the failure rate in the Mid-Term is quite high in the CS1 course as well as in the other courses, leading to many students feeling demotivated. Moreover, the chapters are getting harder and harder over time, with many dependencies on the previous ones. That means that once students misunderstand some concepts, they cannot keep learning properly without reinforcing first those prerequisites seen previously. Both aspects combined likely lead some students to lose the track over time. That inference gets enforced by computing the correlation between the mid-term grades (reflecting students' level after 3 Challenges) and

the number of Challenges students took part in over the semester. The resulting Pearson coefficient is 0.51, held up by a p-value of $4.68e-27$, meaning that, for a given student, the higher their mid-term grades, the more they are stimulated to participate to the Challenges.

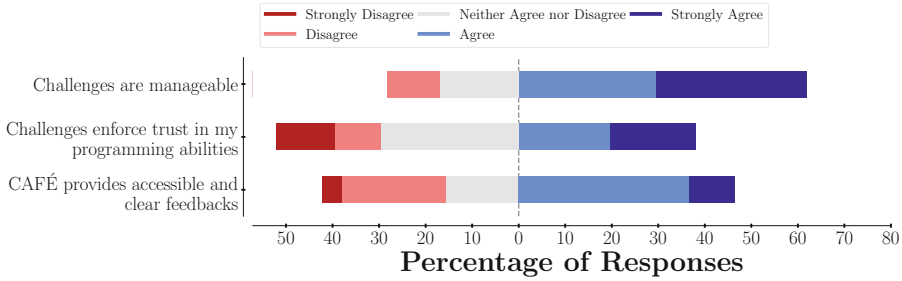

Fig. 4. Students' opinion about how much appropriate the Challenges level is.

From Fig. 4, we can observe that students' opinions are quite divided. 64% of them see the Challenges as an opportunity to train (those being manageable) and 46% find the Challenges give a chance to get better through the feedback. On the opposite, for other students, the Challenges appears too difficult, and they cannot take advantage of the feedback.

To wrap up those last results, we saw that around 60% of students keep performing the Challenges over the semester. On the contrary, a non-negligeable number of students fall behind with the Pca. From those observations, we can draw two main learner profiles: one capturing the participants to the Challenges and another one referring to students who do not take part in it. A likely general root cause to this recurrent clustering is the large diversity of students' profiles since there is no prerequisite to enter the cursus (due to open access policy in our country). We can also notice that the group of students who do not take part in the Challenges grows over time. Very likely, some students find the course hard. They do not see themselves succeeding in the mid-term evaluation and the Challenges and get eventually demotivated. The same phenomenon is observed in the other courses during the semester (e.g., Physics, Math). To overcome it, students need to regularly train, which makes Café necessary, seeing the large number of students that should be assisted. However, as it stands, Café does not seem to offer the learning experience some students need, leading them to stop taking part in the Pca Café is supporting. In further subsections, we analyze more closely how students handle the Challenges through Café and what is their performance, in order to catch how Café contributes to learning and understand why many students lose the track over the semester.

4.2 What's the Impact of Café on Students' Success?

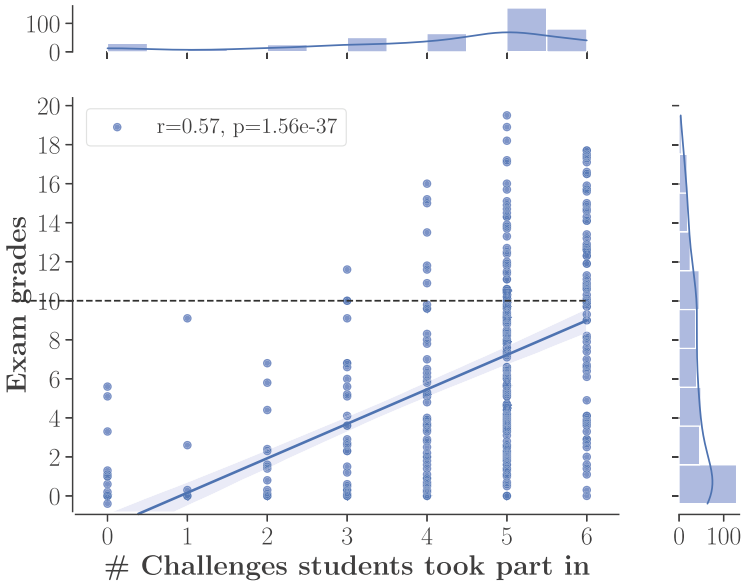

Fig. 5. Correlation between the participation to the Challenges and the learning rate (aggregation over the six years of interest). The histograms (top and right of the graph) gives the number of students per X-Axis or Y-Axis value. Grades range within [0; 20], 10 being the success/failure threshold (illustrated by the horizontal dashed line).

Figure 5 reflects a linear relation r = 0.57 (Pearson coefficient), indicating that the more Challenges students tackle over the semester, the higher their grades in the exam. In particular, from Fig. 5, we can notice that students performing less than five Challenges usually do not outreach the average grade. Students need to tackle five (ideally six) Challenges to really forge ahead and maximize their chance to pass the exam. That demonstrates the interest of the Pca that covers and boosts the whole course through the six proposed Challenges. However, it is also important to recall that all participants chose to be participants, meaning that they tend to be more involved in general.

Besides this, if we restrict our analysis only to the grades, those may appear quite low (most of them being below-average), even when students tackled five or six Challenges. A likely explanation is that some students rush in handling them (that trend being investigated in the next section). Another possible issue is that students cannot draw any lessons from the feedback that is provided. In fact, that last assumption is strengthened by some other studies showing that, more often than expected, students do not read feedbacks at all, especially if they perceive the task as too complicated [17].

In addition to this, we can qualify the impact of the Challenges and Café (both being linked to the other) by completing those pieces of data with some students' opinions.

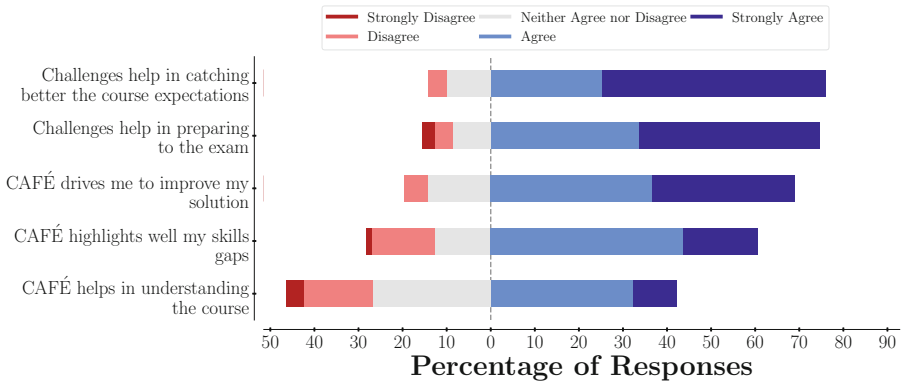

Fig. 6. Students' opinion about how much Café helps in learning in the context of the Challenges.

Figure 6 shows how much students agree on five assertions, the first two ones being related to the remote activity itself and the last three ones to Café. First, most students consider that the Challenges are a good indication on the skills they are expected to demonstrate and attest that those regular statements are a good preparation to the final exam. That underpins the purpose of Café that supports scalable regular activities over the semester. Next, regarding the three statements about Café itself, we can see that opinions tend to be more blurred. 69% of students claimed that the system encouraged them to refine their submission (recall that, for a given Challenge, a student can submit up to three times its solution), which suggests that they can process quite well the feedback they receive. It gets confirmed when we compute the average of the improvement rates of all students, across all Challenges, reaching 29%. To go further, through the next claim, we can notice that 60% of the students say they realized their shortcomings thanks to Café' feedbacks. However, only 42% think that Challenges effectively helped in understanding better the course, while 27% have no opinion about it and 20% believe it did not bring any added value in their learning. Notice that the rest of the students did not provide any opinion, meaning that, likely, they did not take part in the challenges. From those last three opinions, it seems that some students do not always connect their "local learning" (i.e., what they found out during the Challenge and used to improve their solution) to the global picture of the course. Some may only focus on maximizing their score on the Challenges without keeping track of their weaknesses that are being highlighted and overcome them in the future. The consequence is that we often see the same mistakes occurring across the Challenges, as well as in the exam.

All in all, Figs. 5 and 6 corroborate the conclusion from Sect. 4.1. First, it highlights the potential of Café in boosting learning. Indeed, the more Challenges students participate in, the higher their final exam grades. However, currently, the impact of Café is limited. On the one hand, many students do not think that Café really brings the light to the concepts of the course. That explains why about 40% of them stopped taking part in the Challenges over the semester. On the other hand, the global results of the exam remain quite low, even when students participated in all the Challenges. Those two observations raise the new question: "Why some students do not learn (enough) from their experience with Café?" To answer it, we will focus on students' learning behavior across the Challenges in order to catch how they use that tool in practice.

4.3 How Students Manage Their Time to Handle the Challenges?

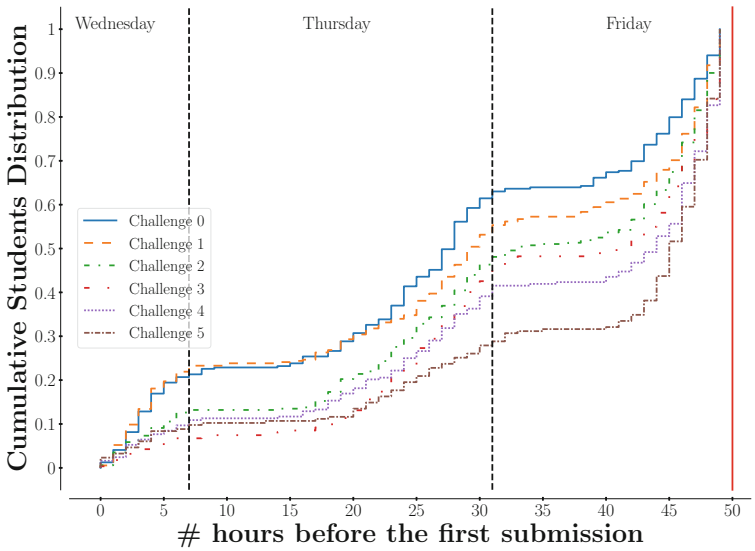

Fig. 7. Cumulative students distribution over the elapsed hours from the moment the Challenge was released (Wednesday, 17:00) up to the deadline (Friday, 19:00). Results concern the first submission and are aggregated over the six years of interest.

Figure 7 shows how the students' first submissions are spread over time with respect to the time the Challenge was published (referred by 0 on the X-Axis). From that figure, we can note that a lot of students (from 38% to 72%) wait for the last day before sending their first submission. Moreover, we can notice that this behavior intensifies over time, which is reflected through the curves that shift downwards across the Challenges. More precisely, for the first two Challenges, more than 53% of the students submitted the first version of their work

before the last day while only 28% did so for the last Challenge. In addition, when we focus on the last submission days, we can see that 30% of the students sent their first submission in the last two hours for Challenges 4 and 5. As the topics are getting more and more complex over time and the students more and more used to handle Challenges, we would have expected the opposite behavior. Here, it seems that students are increasingly rushing to solve the Challenges. A possible root cause is that students take more time to build their first submission since the Challenges get harder. If so, that means that many students spend several days in designing their solution before collecting any feedback. Some other explanation is that students get more tired (especially for the last Challenge occurring during the last week of the semester) and feel less motivated, leading them to procrastinate [1].

Besides this, Fig. 7 also shows that, for each Challenge, for each day transition, some plateaus occur. Those reflect the night as well as the morning of the next day. From Wednesday to Thursday, the plateau even includes the afternoon. Regarding the night submissions, to complement Fig. 7, we computed the students' proportion that submitted their work between 00:00 and 06:00. On average, over the different years and all the six Challenges, 5% of students handled at least one Challenge during the night. Next, the limited number of submissions in the mornings and Thursday's afternoon can be explained by the fact that students are supposed to attend classes. Still, on average 24% of the submissions occurred during that period. That means that either they chose to not attend a course, either they "split their attention" between the Challenge and the course, likely leading to a lower-quality refreshed solution.

From those observations, we can say that students do not optimize their work conditions to handle the Challenges, which reduces their opportunity to properly understand the feedback and take benefit from their 3 submissions per Challenge.

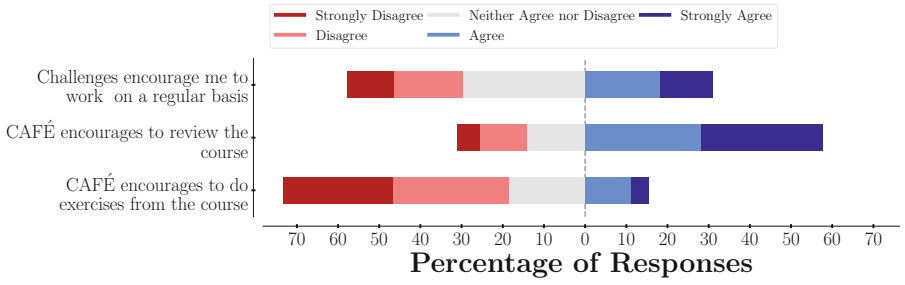

Fig. 8. Students' opinion about how much CAFÉ fosters general regular work throughout the challenges.

Putting this data in perspective with the students' perception, Fig. 8 shows that only 31% of students use the Challenges as springboards to boost their general work through time. Besides this, 58% of students felt the need to review

the course, either because Café explicitly directed them to a specific topic or to understand better the feedback. However, very few students spontaneously extended their practice of the course by autonomously solving exercises.

In summary, from Figs. 7 and 8, we can say that Café does not really influence students' work outside the scope of the Challenges, even when they see a Challenge coming (otherwise, we would likely observe earlier submissions since students would feel more at ease to solve them at the time Challenges are published). It suggests that the motivation of many students is mainly fed by close reward (referring to the grades) and feedback. Outside that context, many students do not spontaneously work on their own.

4.4 How is Students' Self-regulation of Time Management Related to Their Performance?

Finally, now that we understand better how students manage their work time across the Challenges, we aim at evaluating the relation between their time management and their performance. Two perspectives are considered: a local one and a global one.

First, we check the "local students' performance", i.e., the performance that results from the current activity students are handling over the days of interest (the Challenges in that case). More precisely, for each Challenge, and for each elapsed hour, we grouped together all students who submitted at that time, and we computed the average of their final grade to the current Challenge. The resulting graph is given through Fig. 9, where the grades (ranging in [0; 20]) are depicted through a color. The mapping between the colors and the grades is given through the color bar on the right of the figure. That bar is centered in 15 in order to better highlight the difference between the grades related to the last day and the grades linked to the previous days.

From Fig. 9, we can notice that the later the student submitted their work, the poorer the final solution. Those results enforce what was inferred before: working in last minute does not allow to properly think and integrate the feedback that is provided, leading students to miss the opportunity to really learn from the Challenges. Joining those results to the ones from Fig. 7, we can see that, despite low grades obtained in the previous Challenges, students generally keep waiting the last eight hours to submit their work and refresh it, without stepping back. That static behavior can be due to many factors like a motivation drop, a lack of self-regulatory skills, a recurrent underestimation of the expectations, or some "hidden" collaboration where a large group of students wait for some others to submit their work, so that they can take advantage from others' feedback, without losing their own attempts. Moreover, like we saw in Fig. 7, some students submitted their work during the night, which led to a final poor solution in 47% of the time. However, it is important to notice that those poor solutions were not necessarily the ones submitted during the night since every student gets up to three trials and the time recorded here refers to the first submission.

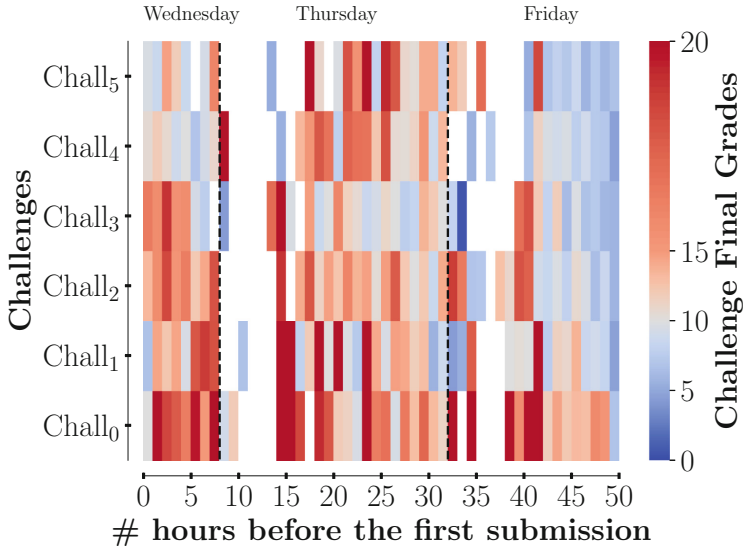

Fig. 9. Average Challenge grades (color bar centered at 15) at each submission time (X-Axis) for each Challenge (Y-Axis). Results are aggregated over the six years of interest. (Color figure online)

Besides this, a more global view is given by modeling students' time management and correlate it to their final skills level, reflected through the exam grades. To model students' time management, we compute the average time of their first submission over the six Challenges, and we derive the elapsed average time from the Challenges publication. The idea behind that modeling process is that students' time management across the six Challenges reflects their time management in general. Similarly, Hooshyar et al. [6] also used student' assignment submission behavior to model students' procrastination trend. The resulting relationship is illustrated in Fig. 10.

In accordance with previous results, that last figure shows that the later the students submitted the first version of their solution, the lower the exam grades they obtained, eventually. That observation can be extended by stating that the more time you take to process the topics, the more you will learn in long-term. That claim appears reliable seeing the very low p-value behind that analysis (see Fig. 10). That also fosters again the necessity to engage students along the semester through regular activities in order to reduce procrastination behavior and naturally integrate learning in the students' day-to-day lifestyle.

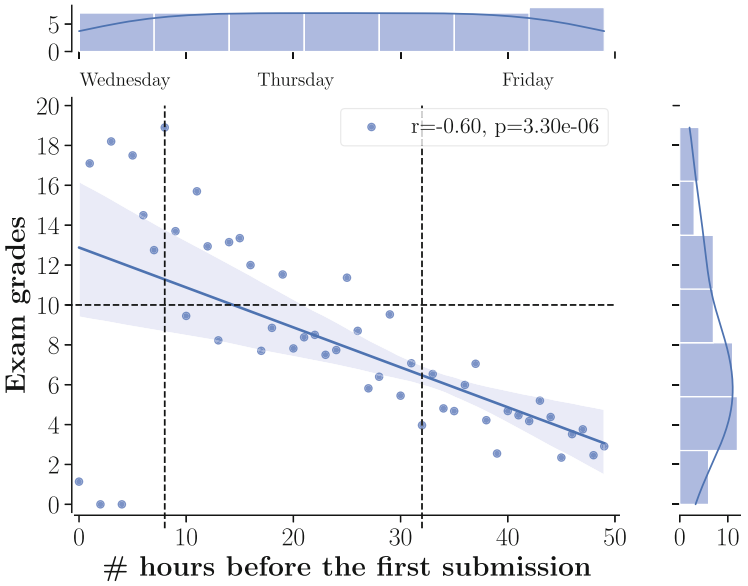

Fig. 10. Correlation between "last minute" trade and learning rate (aggregation over the six years of interest). The histograms (top and right of the graph) gives the number of students per X or Y value. Grades range within [0; 20], 10 being the success/failure threshold (illustrated by the horizontal dashed line).

5 Perspective and Conclusion

To wrap up, the whole results exposed in previous section reveal that Café can make the difference on students' success, due to its purpose to supervise regular work. Automatic grading and feedback to assess students can increase their motivation to practice continuously (which is required to learn to program) [12]. However, currently in our course, many students soon or later fall behind anyway (which is reflected through the participation drop in the remote activity as well as through the low performance students demonstrate in the Pca and the exam). One reason is that many of them do not use the tool in an optimal way (working very close to the deadline, waiting for the challenge period to review the course, likely not digesting properly the feedback) leading many students to lose the track of the course, eventually.

From that observation, our goal now is to bring Café to an upper version such that it offers a more suitable experience to students. More specifically, we can define three global features of success a blended learning environment should have. First, the system needs to be attractive to drive participation. Next, its content should b e accessible for any student. That can be developed by making more flexible and achievable statements as well as by providing appropriate feedbacks. Finally, Café should clearly embed learning over time to make students fully aware of their learning progress with respect to the final course objectives

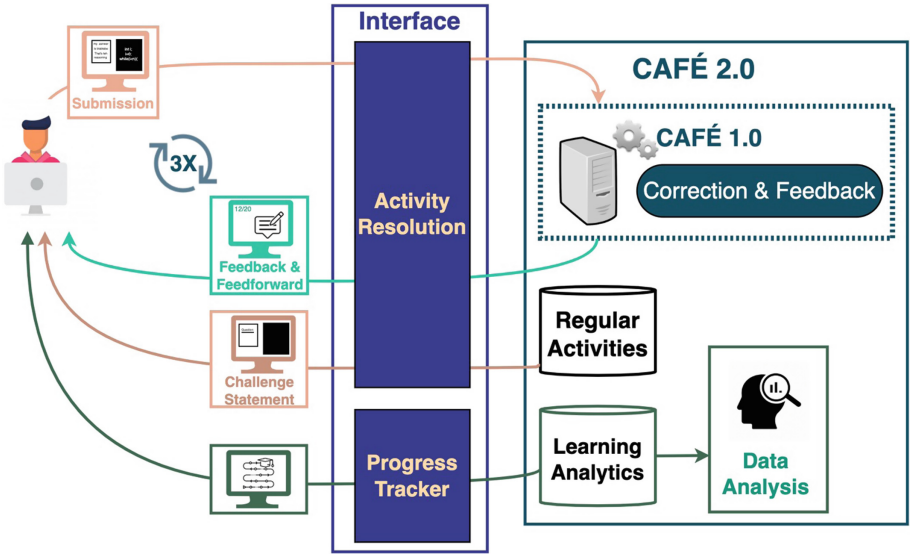

Fig. 11. Expansion of Café from its current version (Café 1.0) to the upper one (Café 2.0).

and help them organize their time around the remote activities. Flexibility and time organization match with what Alavarez et al. [2] defined as requirements a computer system should meet in order to adequately support students in a Blended-Learning context.

Figure 11 gives an overview on Café's upcoming evolution from its current version described before, through Fig. 2.

In particular, Fig. 11 reflects how Café 2.0. will expand and encapsulate the activities from end-to-end (instead of just handling submissions). The goal behind that is to build a more user-friendly system that better onboards the students, overcoming the recurrent participation drop. Rather than just punctually supporting Challenges submissions, we aim to turn Café into a platform that will be more integrated into the course [5].

Regarding the activities, besides the Challenges, students should get other opportunities to train with that automatic supervision. A first slight upgrade would be to give back access to Challenges after the deadline, without altering the grades. This way, students could take more time to assimilate and apply the feedback to refresh their solution. Further than this, we could also include into Café another type of activity [8] that would be fully facultative and always available from the time the topic of interest has been taught. In this way, students would be able to train under less pressure, at their own pace. More generally, they would also get more diversity in their learning activities, which is likely to facilitate the development of task value, especially their interest [14].

Next, regarding the automatic supervision, Café should offer a closer guidance in order to "keep students tuned" and naturally direct them to correctly

and rigorously solve statements. Guidance can be set at different levels. First, we should define intra-statement guidance including more step-by-step resolution as well as a better error catcher and resulting feedback. Decomposing students' resolution into pieces will make it more accessible. Furthermore, by zooming more on each resolution step, on one hand, students can acquire a better resolution structure, and, on the other hand, we can easily put in place specific short theoretical reminders, hints, and local feedbacks to guide the student towards the solution. Of course, the idea is to progressively relax that resolution framework in order to finally see the students handling properly problems on their own. Secondly, we should shape their time management and develop good habits in their working lifestyle, like already implemented by Su [16]. Typically, we could lock the platform during the night (as well as during course time). Furthermore, in response to large number of last-minute submissions (leading to poorer solutions, as depicted through Fig. 10), we should define some inter-statement guidance, so that students get a clear view on which tasks they achieved and what they should do next. That third feature appears essential to balance the self-paced learning environment supported by Café, where students are susceptible to procrastinate [7,15]. As a first upgrade, we could create a dashboard (called the Progress Tracker on Fig. 11) through which they could visualize:

- A progress bar comparing topics that have been taught in classroom activities and their current activity on the different topics. In this way, students could better realize where they still need to put efforts.
- More specifically, the remote activities that are open and need to be performed. Typically, for the Challenges, the students would see how much time remains to achieve it.

In further versions, we could even recommend some specific statements based on each students' level. However, that functionality involves many prerequisites, including the collection of more refined data (stored as Learning Analytics, as shown in Fig. 11). Data provides more transparency about individual students' learning behavior and resulting performance. At a higher level, through this paper, it already gave us the direction to take to empower Café in order to keep more students in line with the course. Although, that step just sets the pace for further enhancements. By catching closer and closer students' learning behavior, Café will be able to regulate better and better every student's learning, forging a more and more optimal blended learning environment.

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Teachers' Professional Development

The Effect of Gamified Flipped Classroom on Vocabulary Learning of Primary School Students in a Private School in Turkey: Students and Teachers' Experiences

Ayşegül Liman-Kaban(✉)

Bahçeşehir University, Istanbul, Turkey
aysegul.liman@es.bau.edu.tr

Abstract. Gamified flipped learning has become admired in language teaching and learning as a creative and effective way to improve student learning and encourage them to comprehend and process new knowledge. The purpose of this study was to investigate how a gamified flipped EFL classroom affected second-grade students' vocabulary learning in a private Turkish school. The students were assigned into two groups: experimental and control. There were 20 participants in the experimental group, and 20 in the control group. Teacher reflective journals and structured student interviews were used in this study. Following the treatment of the experimental group, both the control and experimental groups were given a posttest. The results of this study's experimental group posttest attempted to show that using gamified flipped classrooms improved the experimental group's mean score, and also had a positive impact on students' engagement, and increased their motivation toward learning in in-class gamified activities. The key findings of structured interviews were students wanted more interaction inside the videos. They also claimed that they liked the use of hands-on activities in online synchronous classes instead of having only instruction.

Keywords: Flipped learning · Gamification · EFL · Gamified flipped learning · Primary students · Vocabulary learning

1 Introduction

Looking at the recent past, it is believed that the world's economy and industry have developed significantly, which has caused extensive anxiety among countries in terms of education. Due to this considerable advance in technology and education, among different types of learning achievements, the flipped classroom is the popular one (McLaughlin et al. 2016). The flipped classroom has been commonly implemented in a variety of educational settings, with positive outcomes including better academic achievement and interactions between teachers and students, enhanced motivation in learning and performance, and facilitated interrelationships and collaborations among students (Hsieh et al. 2017). The strategy of the flipped classrooms is that learners are granted to understand

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and comprehend the topics before attending the class leading learners to enhance most of the topics and overcome their weaknesses (Abeysekera & Dawson, 2015). Thus, while attending the class they learn more through small group discussions, presentation, and problem-solving activities (Bishop & Verleger, 2013), and activities consist of higher thinking abilities (Hwang et al. 2015; Zou & Xie, 2018). The typical input-based teaching method emphasizes what should be included in the syllabus. Because teachers are often preoccupied with how they should educate in each session, it is primarily lecture-oriented, with little learner participation. The flipped classroom, on the other hand, would be a more student-centered and performance strategy that stresses the utility of student performance and encourages students to notice and apply new material. (McLean & Attardi, 2018). The impact of technology-enhanced language learning has grown due to the significance of technology in promoting learning motivation and productivity. (Fabian et al. 2016; Gu et al. 2015). The use of games is another approach for enhancing learners' enthusiasm to learn English and lessening their fear about using the language (Hung, 2018). Furthermore, because its student-centered nature is associated with the method of effective language education, the. flipped classroom has gained wide attention from the language education research group (Hung, 2018).

The aim of this study is to investigate the effect of Gamified flipped EFL classroom on learning the vocabulary of second-grade students in a private school in Turkey: Students and teachers' perceptions. Based on this, the research questions are as follows:

RQ1: What are the experiences of primary school learners gamified flipped EFL classrooms?

RQ2: What are the experiences of primary school teachers gamified flipped EFL classrooms?

RQ3: What is the effect of gamified flipped classroom approach on primary school students' achievement?

1.1 Flipped Learning

The term "flipped classroom" relates to a reversal of conventional scholastic approaches in which straightforward orders that were formerly given in class are now given from outside the class and immersive tasks that include high-order cognitive skills are the primary practices within the school environment (Hwang et al. 2015). There are actually multiple theoretical frameworks that have been split down into various fields of expertise with the hope of creating an education process more dynamic, interactive, and collaborative for students. The information gained in students' personal spaces and prior to class is essentially in the form of videos with accompanying exercises; and in-class events. Team time and space are often organized in the form of pair or community conversations, drills, or tasks (Hung, et al. 2018). The Flipped learning approach is, by necessity, a two-phase process. The first step entails acquiring content by visualizing it using the tools supplied by the instructor; these resources include formats such as videos and podcasts, among other things, (Strayer, 2012). The second step is established in the classroom, where students engage in collaborative reads, problem-solving, tests, role-playing, designs, crafts, and other activities that are all based on the topic or theme being focused on at the moment (Ng, 2018). Since the 1990s, the flipped classroom strategy has been applied to education and training to offer more involved and varied sessions for educators on one

side, and to increase access to new technology for the gaining experience on the other side (Låg & Sæle, 2019). While there is no standard figure for flipped classrooms, they all follow the same idea of the instructional series. Personal learning exercises outside of class, usually as homework, complement the traditional education framework of preparatory F training in class. In flipped classrooms, this instructional foundation is essentially face-to-face reversed. Students learn with a self-study period, normally accompanied by digital content, in which they gain information at their own rate. In other terms, direct teaching shifts from the social learning environment to the individual learning environment (Sailer & Sailer, 2021). In terms of the kinds of learners that profit the most from flipped language classrooms, the research suggests that students with more academic maturity, a higher degree of commitment, and older age can make the most of such a successful and creative solution (Chuang et al. 2018). Therefore, the more independent and self-regulated students are, the more efficient and useful the flipped lessons are. The shift in conventional pedagogical schemes, as well as the periods inherent in the art of flipped classrooms, has contributed to a series of intellectual prospects. This approach increases their enthusiasm, active learning, devotion to the task, engagement, involvement, social interaction, independence, and even internal rate control of education (Sailer & Sailer, 2021). According to Fisher et al. (2017), these enhancements had a strong impact on students' achievement and outcomes, culminating in a rise in appraisal exam results. As a result, numerous published articles in peer-reviewed research journals have confirmed the usefulness of flipped learning in comparison to conventional educational approaches, highlighting the full important developmental value of this creative methodology (Huan, 2016; Pozo et al. 2019). In general, flipped classrooms have the capability to enhance learners' involvement and independence compared to traditional lessons.

1.2 Gamification

The implementation of game elements in non-game situations is known as gamification (Deterding et al. 2011). Gamification can be defined as an aggressive approach to learning that employs game frameworks, features, and concepts in formal academic contexts (Attali, 2015). While some teachers include gamification in their lessons, many more are unaware that this style of recruitment is able to motivate and instructing students in a fun way. One of the most important aspects of using it is that the students have completely absorbed the performing simulations that would be used (Parra González et al. 2020). Games have undergone a digital revolution as a result of technological influences, providing for the training of varying lengths ranging from more traditional games to the most innovative games with large digital loads. By use of gamification in instructive action benefits student engagement, which is enhanced as a result of this novel approach (Banfield & Wilkerson, 2014). Similarly, through use of games increases several educational metrics, including the dynamic and collaborative elements of learners, instructors, and material. Gamification further helps to increase student engagement, motivation, and perceptions regarding educational processes (Perez Manzano & Almela Baeza, 2018). This is the situation of Flipped Classroom and gamification, all of which center their discursive concepts on the recreational elements of games. The term "pre-class self-learning" involves the delivery of information. As a result, gamification can boost students' motivation and performance in a fun way, allowing them to connect more

with other learners and lecturers than other educational techniques. Gamification allows students to develop their skills in gameplay that does not require obvious effort, which improves their participation and commitment in learning experiences of a playful nature (Simões & Vilas, 2013). Apart from conventional methodologies, game-based learning recognizes any effort taken in response to successes, thus benefiting students' attitudes, engagement, and enthusiasm for new learning opportunities, which has a larger effect on success and ease in the course content (Deterding et al. 2011). Gamified learning theory suggests two ways in which gamification can affect learning through behaviors and preferences. Behaviors and actions, depending on their particular intent, will either regulate or arbitrate the interaction between educational material and teaching strategies (Landers et al. 2015). Quizzes are sometimes used as a jumping-off point for gamification in educational environments. Gamified quiz sites such as Kahoot!, Quizalize, and Quizizz have seen increased use in education-learning environments in past years. Typically, such sites offer task-level reviews by granting points for correct responses (Sailer, 2021). One benefit of gamified quizzes is that they have instant feedback on the spot. So, by this, we have the chance to provide the learners with their strengths and weak points while they are playing the instructional game. Points in gamified quizzes give quick task-level input, which has the ability to truss education efficiency. Better output throughout learning cycles can lead to higher useful content use as a result. Another aspect that quiz platforms deliver is the ability for students to engage in collaborative or cooperative ways, typically by scoreboards or team leaderboards. Gamification also employs competitive forms of social engagement (Sailer, 2021). With all these points to the conclusion that innovation plays a critical role in gamification since it allows one to create diverse training drills via online games, which, due to their widespread availability, will create education in any environment, whether traditional, semi or unofficial.

1.3 Gamified Flipped EFL Classroom

Another method for increasing students' desire to acquire the knowledge of English and decreasing their concern regarding practicing the language is to teach them by games. Teachers and scholars have extensively used and researched the use of games in learning languages. Hung et al. (2018) conducted a review of educational exhibits in language instruction and realized that a wide range of games had been used in language acquisition, including interactive games, especially deeply massive single-player character games, instructional games, integrated database, simulations, and adventure games. Given that games are successful at increasing student involvement, incorporating games in the flipped learning can help inexperienced instructors involve learners (Zou, 2020). There is clear evidence that using game-based teaching methods will minimize English as Foreign Language learners' uncertainty regarding practicing English and encourage them to engage more effectively in the activities in the classroom. One of its most common gamified techniques in the class is role play (Ho, 2020). Nonetheless, studies found that new teachers participating in flipped classrooms were concerned about how to engage learners and take advantage of the extra time in the classroom, and learners could perceive face-to-face teaching as less structured while teachers behaved as a facilitator rather than an educator on hand (Zack et al. 2015). Students gain more language skills by playing games – whether video or kinesthetic games – than from traditional schooling.

It is also critical to investigate how gamification and flipped classroom experiences, in which the learners are typically accompanied by multimedia content that allows them to gain information at their own speed, affect student success or how effectively they apply newly learned skills. According to a study conducted by Ho (2020), In terms of technological involvement and learner independence, the usage of a classroom flip mixed with game-based learning activities had a favorable influence on students' education. Student's behavioral, perceptual, and motivational involvement were all improved by using a gamified instruction approach. Language games can help students improve their academic involvement, reduce their stress and refusal to use English, as well as prepare them for exams (Ho, 2020). In our study, the element that made the flipped lesson gamified is using the Quizizz platform which has factors of a gamification website such as background music, cartoonish icons for participants, scoreboards, and so on.

2 Methodology

The design for this research was a pre- posttest quasi-experimental design. In this study, researchers controlled the descriptive statistics of the collected data from both tests. The core properties of a study's data are described using descriptive statistics. They provide concise summaries of the sample and metrics. They, together with simple data presentation, are the basis of almost all statistical techniques. These designs were comparable to those used in exploratory studies, but there were a few key differences. The researchers discovered an independent variable that has no impact on the dependent variable, and they evaluated the impacts of the predictor variable on the measured variable. Rather than allocating them at arbitrary, the investigator must employ naturally formed or pre-existing groups. The independent variable was the use of gamified flipped classrooms in the English language context and the dependent variable was students' vocabulary improvement and their perceptions. Classes were assigned randomly to control and experimental groups and the teacher for both groups was the same -one of the researchers in this study. Experimental and control groups were exposed and introduced to the procedure of the flipped classroom. They were supposed to watch the assigned video clips about the new vocabulary. The pre-test was done with both groups. After the treatment is conducted to the experimental group, the posttest administered to both control and experimental groups to find out any difference between the two groups (Creswell, 2012). The experimental group was exposed to the gamified lessons using the Quizizz gamification platform, while the control group just received the instruction based on the usual method of teaching using the course book.

3 Setting

The COVID-19 has forced the closure of schools all around the world. As a consequence, education has undergone significant transformations, with the growth of e-learning, in which students are taught offsite and via online platforms. Increased internet distribution is one of the fastest-growing phenomena in current education. Due to some restrictions of Covid-19, the experiment of this study conducted through the Zoom online platform. Online training focuses on Internet-based classes that were available both synchronously

and asynchronously. Synchronous education is a type of learning that involves direct communications between learners and instructors while also employing online means of communication such as workshops and online chats. So, as the learners and instructor joined at the same time to the same platform in order to run the sessions, this experiment included synchronous education. The study was done within two consecutive weeks. Each week included four different sessions with a control and experimental group. In total 8 sessions. The duration of each separate session was 30 min.

4 Participants

There were 18 participants in this study who were 7–8 years old, 2nd-grade students of private chain school in Istanbul. The control group consisted of 25 participants (12 male, 13 female). One student was set as an outlier and his data was deleted since he was not joining the English lessons, because of this reason the control group consists of 24 participants (11 male, 13 female). The experimental group included 24 participants (14 male, 10 female). The participants were members of the same classroom during face-to-face education; but since the education was being conducted distantly due to the Covid19, the class was divided into two groups so that all the participants could join the lesson actively. The participants were familiar with the online platform (Zoom), the learning management system (Metodbox), and the gamification tool (Quizizz). The participants also had been learning English for at least 3 years.

5 Instruments

5.1 Teacher Reflective Journals

Expressing oneself by writing is a high level skill, so writing and thinking are in coordination with each other in this process. Reflective journals help making inferences, realizing connections between concepts and propositions to arrive at a conclusion. Structured Interviews A structured interview form was developed to collect data. Structured interview form was created after the literature review, submitted for expert opinion. After expert opinion, structured interview form given its final shape. The structured interview form consists of two parts. In the first part demographic questions were asked to determine the characteristics of primary school learners. In the second part, the problems, solutions and suggestions encountered in the gamified flipped EFL classroom environment has been asked. Due to the age of learners in this study, for recognizing how primary students perceive gamified flipped classrooms, in the experimental group, instead of having an interview researchers asked below five questions. In other words, because they were young learners with insufficient English skills to respond to a written assessment scale on the experiment, their points of view about the gamified lesson were gathered verbally. To respond to the questions, the instructor asked students to show their opinions with a thumb up or thumb down. This questionnaire generated by one of the researchers in this study.

1. Did you enjoy the lesson?

2. Do you think you learned more than 80% of the content?
3. Did you like the videos you watched at home?
4. Can you explain the content of the lesson to your friend?
5. Do you want to have gamified flipped classes more?

6 Gamified Assessment

For our study the researchers used Quizizz, an online platform that allows teachers to lecture, schedule breakout events, gather feedback, and use low-stakes testing methods from everywhere. Classes, like quizzes, are free to use. Teachers can design their own Courses or choose from the several Lessons created by other educators in the Quizizz library. Quizizz is a free online app that allows teachers to create and take multiple-choice quizzes. Similar to Kahoot! and Quizlet Live, it offers competitive, multiplayer games in which there is an option for setting a time limit for each question, music during answering time, and also students are able to see the true answer after the time limit and also their step-by-step scores after each question on the leaderboard. Moreover, after joining the game, each student will have her/his own funny icon. Quizizz is intended to make studying more enjoyable and engaging for students. Teachers can create a quiz on the web and play the Live Game online game mode. For this study, the second-grade students as the experimental group were asked to answer the prepared questions in the Quizizz application on their tablets.

7 Learning Management System

Another tool that was used during this study was Metodbox. Metodbox provides a customized and indigenous education framework to its users. Metodbox can be used on a website, a mobile website, iOS, and Android apps, and it provides users with an indigenous education portal. Metodbox is a K12 education platform that can be linked and used everywhere. It is used by KG, primary school, secondary school, high school, and university readiness students, classroom and branch teachers, school administrators, and parents of participant students. With Metodbox rich content students and teachers can find thousands of materials such as lectures, question banks, videos, study fascicles, etc. in accordance with the ministry of education curriculum. Meteodbox also has a goal-setting function. Students will submit their desired outcomes and the program will assist them in developing strategies that are in line with their objectives. In this study, the instructor was not using Metodbox on the live sessions. The related videos assigned to students as homework. Researchers used theme 5 unit 3 from second graders' Metodbox materials in this study.

8 Procedures

After conducting the pre-test, the lessons were taught to both control and experimental groups. The topic was vocabulary. In both groups, the participants were supposed to watch the videos in Metodbox as they had assigned them for their homework Figs. 1 and 2.

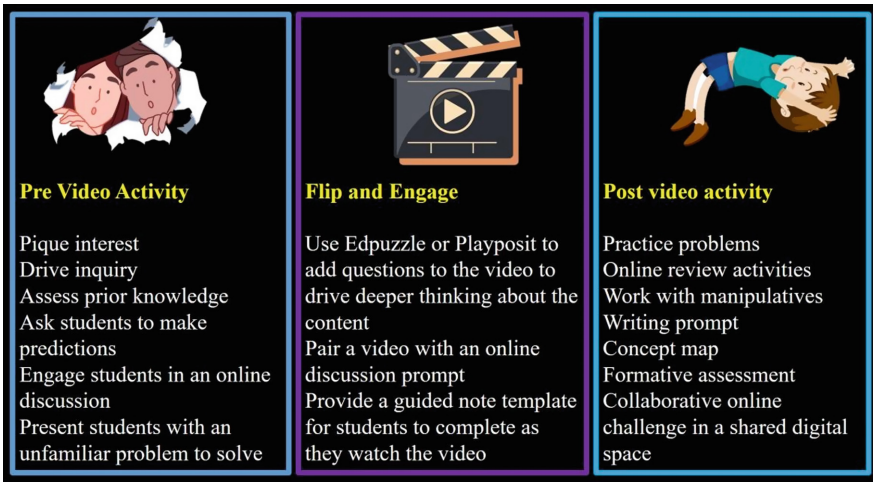

Fig. 1. Details of the flipped learning activities

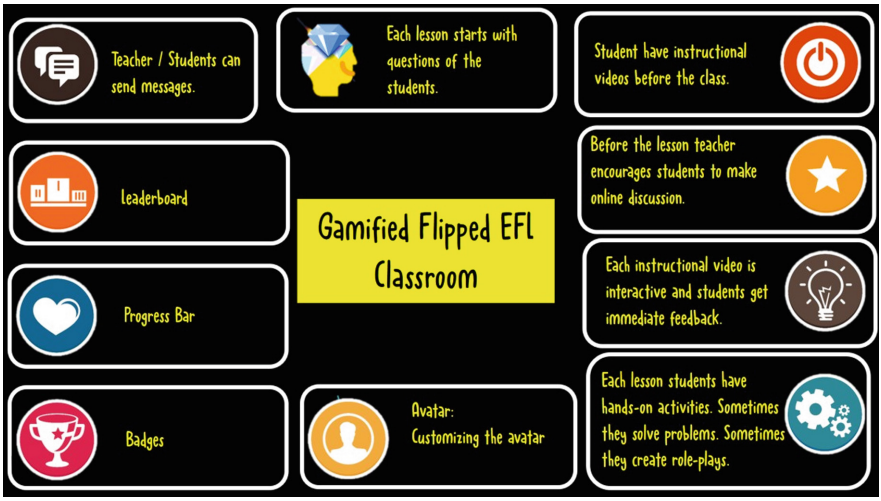

Fig. 2. Features of the gamified flipped classroom

The control group received the instruction through the same method of learning as they always expose to the context using *Bloom Level 2 Book C*, while the experimental group was supposed to learn and review the related and same vocabulary through gamified lessons using the Quizizz platform. After delivering the instructions within two weeks, the post-test was conducted. The results of the pre and post-test were analyzed by conducting T-test using SPSS 26. To better understand the learners' and teacher's perceptions, the interview was conducted as stated in the data collection part.

9 Data Analysis

After conducting the pre-test for both control and experimental groups, the vocabulary sessions were implemented separately. The control group learned the same vocabulary through their course book, while the experimental group received and reviewed the vocabulary using gamification. The duration of the study was two weeks. Each week included 4 different sessions with both of the target populations. Every session was 30 min. After delivering the instruction through the above steps, both groups were assigned to take the post-test. Each test including pre and post possessed 10 vocabulary questions. In the end, the collected data was imported to the SPSS software. The Cronbach's alpha reliability coefficient of pre test scores was 0.89. The Cronbach's alpha reliability coefficient of post test scores was 0.92.

Thematic analysis was used in the analysis of the qualitative data. The findings are grouped under certain themes. Thematic analysis is used to describe data by associating similar data with certain concepts and themes that can explain the collected data. Maxqda, a data analysis tool, was used to code the information. At this phase, the researcher obtained feedback and suggestions on the categories and themes from subject matter experts. During the content analysis phase, the data were described according to the theme and codes. To avoid ethical difficulties, the study did not use the names of the students. Instead of student names, codes were utilized.

10 Findings

As shown in Table 1, there is no statistically significant difference between the post test results of the experimental and control group students participating in the study ($t(69,247) = 1.100$, $p = 0.293 > 0.05$). This result shows that the students have similar levels of achievement after the treatment.

Table 1. T Test Results of Post Test Scores of Experiment and Control Group Students

Group	X	S	Std. Deviation	t	P
Experiment	24.62	5.371	69.247	−1.100	0.293
Control	26.43	4.038			

Students' experiences in the experimental group

Participants in the experimental group showed a good level of participation. Students' ideas were asked at the end of the experiment. Since they were young learners and their English level was not sufficient enough to answer a written evaluation scale about the experiment, their opinions were gathered through semi structured interviews. When they were asked, the students stated that they enjoyed the application and the quizzes, and they asked if these kinds of applications could be used in each session. Categories that emerged upon the content analysis are as follow: getting ready, interaction and feedback, sharing questions.

1. Getting ready

Students' comments included keywords like enhanced efficiency and productivity in terms of both the product and the process, according to the research. The majority of students feel that by the end of the process, they will have produced a well-prepared product. Some people have also reported feeling more satisfied with the work and the instruction.

The statements below support these findings:

"The videos we watch before the lesson enable us to be ready for in class activities."

"One of the advantages of this class is that we start to learn about the topic before the lesson."

2. Interaction and feedback

Furthermore, participants were greatly involved in the in-class gamified flipped program, according to the researchers' class observation notes. They were attentive in answering questions, had a positive learning attitude, and were highly engaged in dynamic game-based activities. In addition, excellent learning outcomes were attained.

The statements below support these findings:

"I liked having interactive videos as a homework."

"Getting immediate feedback from the interactive videos before the lesson was helpful." "Getting immediate feedback help to improve myself."

3. Sharing questions

The category that dominates the responses about the advantages of the gamified flipped classroom is sharing questions at the beginning of the lesson. Most students have reported that thanks to the video content they come across the content and it enabled them to be exposed to the content before the lesson and taking notes for the problematic parts. Students claimed that at the beginning of the lesson they have time to share their questions and get answers.

The statements below support these findings:

"We have time for questions at the beginning of each lesson."

"We are so lucky as we have a question and answer time at the beginning of the lesson."

Students' experiences in the control group

On the other side, the control group performed the same way they do in usual classes since they were not introduced to any new tools or materials during the lessons. The participation level stayed the same for most of the lessons but also, some students' attendance levels dropped. Since the students were not introduced to any flipped learning materials or gamified tools, the questionnaire was not applied to them. When the participation and attendance level of the two groups is compared, it can be clearly seen that the experimental group showed higher participation and their attendance level was higher than the control group.

Teacher experiences
The teacher of both the experiment and control group has been teaching the class for two years. During the sessions, the participation of the learners of the experimental group was increased due to the excitement of the gamification elements that were introduced using the Quizlet application. Participant teachers reported that students were more motivated in the gamified flipped classes. Having quizzes that were prepared on a different platform than written form or on a word document, increased the participation. Also, the willingness of the participants to take part and discuss the questions and the answers affected the teachers' teaching experience in a good way. On the other hand, the experiment process did not affect the control group in any way since the methods which were used by the teacher consisted of the textbook, and the gamification elements were not implemented in any sessions.

11 Discussion

The analysis of the data implies that there is a difference between the result of the control and experimental groups. Addressing the research question on the effect of gamified flipped EFL classrooms on the perception of primary school learners, from the findings here, it can be concluded that there is a positive impact, with the experimental group outperforming the control group in terms of gamified flipped classrooms on the students' experiences. The result of this study is in correlation with earlier researchers such as Razali and his friends (2020) showed that the intrinsic and extrinsic motivation levels of the students increased with the help of the gamification elements in the application. Halim and his friends (2020) conducted research with 60 primary school students in a state school to investigate the effects of the implementation of "Kahoot" and "Quizizz" quiz games. Their results showed that the students showed better acceptance towards English with the application. Also, the motivation level of the students was affected positively with the help of the gamification elements such as competition, enjoyment, and fun.

Feedback is another important results which needs to be emphasized. Students claimed that they benefited the hands-on in class activities and immediate feedback. When the literature is analyzed, Zou (2020) also claimed that primary students were motivated and fully engaged in in-class activities because they were interested in games and interactions; and better learning outcomes were achieved because the flipped classroom allowed teachers to provide students with more personalized support (i.e., immediate and constructive feedback) based on their learning performance and needs.

Zainuddin (2018) compared participants' academic achievement and reported motivation in a gamified classroom environment vs. a non-gamified flipped appropriate learning style. The gamified flip-class atmosphere, according to his findings, increased engagement and performance. During gamification activities, participants were particularly motivated to participate with and defeat other classmates by amassing as many scores and medals as possible. In another study, Matsumoto (2016) conducted on 174 7th-grade students from a private school in Shikoku, Japan. The researcher used flipped classrooms with gamification components to run an experiment and questionnaire for English as foreign language instruction. For efficient game-based e-learning, this study's

findings underlined the necessity of well-designed tutorials, activities, interfaces, and feedback. It's a reversal of the standard educational model. The study's conclusions can be summarized as follows: in order to undertake effective e-learning with gamification features in the field of flip teaching (foreign language) education, it is necessary to consider both the learners' characteristics and the pedagogies' optimum degree of achievement.

Despite the hurdles, learners found the gamified flipped environment to be engaging, interesting, successful, and rewarding. That is, both teachers and students agreed on the benefits of gamified flipped learning, which included greater learning participation, the development of learning abilities and competence, and enhanced learning performance results. Zou (2020) conducted a study to find out the students' and teachers' perceptions of gamified flipped classrooms in primary education. The result of the study indicates that almost all students believed that this new method of teaching and learning was more engaging than previous ones they had encountered, and they were eager to continue learning in this unique manner. Zou (2020) also stated that, because students were given numerous ways to connect with one another in class, their effective communication could be well performed and enhanced, and with good communication skills, learners' confidence in English learning increased, as the primary cause of their low self-esteem was poor speaking skills, as two teachers analyzed. Games allow learners to think about how issues on the board test might be formulated and also what zones of the content they require to invest additional study time. It's important to note that the gamified flipped learning environment model improved students' practical skills, such as English interpersonal and communication skills, in addition to their awareness of the lesson. Students were more confident in their English practice thanks to the use of game-based approaches. Ho (2020) conducted research to find out the effect of gamified flipped classrooms on the motivation of Chinese ESL learners. The findings showed that combining flipped learning and digital technologies is a successful training strategy. As a result of this strategy, learners were significantly more prepared to participate in class and had more pleasant behavioral responses to the class and their classmates. The outcomes of the study show that game-based learning may boost interdisciplinary education and improve interpersonal relationships in the classroom, motivating students to work together to solve challenges. According to the study, students' opinions of their professors differ mainly because the classes are no more as allocated because they were in the non-flipped course.

Hung (2018) carried out a study on how to make the classroom environment more fun by using game-based teaching materials, and the results reveal that the improved method advantages English learners by reducing their nervousness about conversing English in class and boosting their ability to engage in the learning process. Moreover, by integrating an active learning technique with accompanying learning resources, this research presents a comprehensive strategy for gamifying in-class tasks in the flipped English classrooms, which has been found to be successful for enhancing academic achievement. According to the conclusions of Gómez- research, Carrasco's (2019), augmentation and a flipped-classroom education approach are being implemented. It improved pupils' enthusiasm and relationships with teachers. Prior to joining the classroom, the students were actively engaged in learning by watching videos.

Based on Chen's (2019) research on the effects of Mobile English Vocabulary Learning Apps with Game-related Functions (MEVLA-GF) even without Game-related Features (MEVLA- NGF) on students' perceptions and cognitive progress, it is proved that using game increased satisfaction and effectiveness of learners in terms of learning process. Also, it is demonstrated from the results that using gamification with the help of MEVLA-GF, helps learners to improve their vocabulary retention and motivates them to spend more time in activities related to learning English vocabularies. According to Sailer (2021), it is indicated based on the results of mediation analysis that gamification is an important way of learning process performance. In addition, it affects indirectly application-oriented knowledge. In terms of motivation outcomes, based on descriptive results transported from the study conducted by Sailer (2021), it showed that students got higher motivation with gamification than without it. This result goes on to say the same outcome with our study which is in the experimental group compared with in the controlled group.

12 Limitations

This study had potential limitations. Due to the fact that the number of students in a class was low, the sample size was not as large as it was expected. Another limitation was the way the lessons were conducted. Since the education was carried on online platforms, some participants of the study had internet connection problems during the experiment. The researcher that conducted the experiment was the teacher of both groups for two years so that situation could cause biases through the participants. For further research, this study can be conducted with larger sample groups to see the effects of the gamification tools in flipped education.

13 Conclusion

The findings of this study were largely consistent with earlier research, implying that while flipping the classroom benefited, it did not result in significant gains in primary children' learning performance and skills (Chuang et al. 2018; Lee and Wallace, 2018). Since the main aim of the current study was to investigate the impact of the gamified flipped classroom on learning vocabulary, the results of this study via experimental group posttest attempt to illustrate that the application of gamified flipped classrooms has a positive impact on students' involvement and motivation in the in-class gamified activities. It is worth pointing out that students were focused when answering questions, showed a positive attitude for learning, and were fully immersed in the dynamic game-based activities. Students' social, cognitive, and affective involvement increased as a result of the game-based education process. Not only did the exercise encourage social contact, but it also functioned as a review course for students to explore areas for development and ready for the review course. Students' enthusiasm in sharing their ideas in front of the class was also increased. In addition, excellent learning outcomes were attained. According to Loewen (2014), high levels of motivation and engagement were needed for deep learning, which tended to result in effective language acquisition over time; hence, the flipped EFL classroom must be continued, and more significant benefits are likely to

be observed. Finally, it can be deduced that there is a great impact on the attitude of the students, with the experimental group surpassing the control group in terms of attending the gamified flipped classroom. It is suggested that by extending the intervention. During the course of a prolonged length of time. Researchers could look into how students feel about gamified flipped learning. The effectiveness of technologically game-based flipped learning methods in a range of basic and practical English classrooms should be investigated further in the future.

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Teachers' Technology Use, Decision-Making Process and Concerns in Data-Informed Teacher Inquiries

Merike Saar(✉) and Mart Laanpere

The School of Digital Technologies, Tallinn University, 25 Narva Road, 10120 Tallinn, Estonia
merike.saar@tlu.ee

Abstract. Data-informed teacher inquiry into their own practices should help teachers pick most effective teaching methods for each particular group of students and teaching situation. However, there is not much research into the thought processes that teachers employ when making these decisions. This study is an attempt at finding out how data about teaching and learning from physical classrooms, collected with digital tools, could help teachers in adjusting their teaching methods and strategies to improve practice. The study explores how 12 Estonian teachers perceive their own technology use and teacher inquiry (TI) practices, and how much this corresponds to reality. Also, how data-analysis skills satisfy their actual needs and what problems they encounter within a technology-enhanced TI process. Survey data and TI diaries are analyzed using descriptive statistics and qualitative content analysis, and the teachers' perceived knowledge of technology and teacher inquiry is compared to their actual application of these in 18 interventions. In addition, thematic analysis is applied to TI diary entries about teachers' sense-making and interpretation of the collected data to provide insights into teachers' decision-making processes, which would enable improvements to teacher inquiry models and further inform the development of different teaching and learning analytics (TLA) tools. Finally, teachers' concerns connected with different stages in TI facilitation are calculated to identify how these relate to teachers' application of TI.

Keywords: Teachers' technology use · Teachers' digital literacy · Teacher inquiry · Making sense of classroom data · Concerns in teacher inquiry

1 Introduction

Research indicates that teaching and learning analytics (TLA) provide help for teachers in their pedagogical decision making (Sergis and Sampson 2017). However, different issues need to be tackled before data and analytics use can become an everyday practice at schools. In this article we differentiate between data-driven and data-informed decision making: the first describes a process which starts from data and uses mostly automatically collected and analyzed (big) data, while the latter (data-informed decision making process) starts with an inquiry question that would denote the data needed to answer the

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question(s), and need to be purposely collected or extracted. Both processes have their positive and negative sides (large data sets vs scarce data from physical classrooms; data corresponding to the individual needs of the instructor; etc.).

Mandinach (2012) brings out the two key components of data-driven decision making: **technological tools** to support the inquiry process, and **human capacity** (teacher data literacy). When educational data-mining and data collection from online learning platforms has gathered momentum, the developments on the human side have not been that fast. Challenges connected with teachers' data use are several (Marsh and Farrell, 2014). Kaufman et al. (2014) and Mandinach and Jimerson (2016) list the following: continuous learning (data-use related knowledge), data-skills (including technology enhanced data-collection), data-use becoming an integrated component of an educator's work, sustainability of impact (enhanced through continuous support, collaboration and data-teaming) amongst others. Mandinach (2012) also points out the possibly low quality of educational data that teachers can manually collect. So, it is essential to provide teachers with more technological support for systematic teacher-led data collection (from face-to-face, hybrid and online classrooms), as well as guidance on the interpretation of such data in teacher inquiries, which the present study focuses on.

It is clear that data-informed decision making does not only depend on teachers' readiness to collect and use data to transform instruction but requires certain skills and competencies. Jimerson and Waymann (2015) outline six: (1) asking the right questions; (2) integrating data use with curriculum, instruction, and assessment; (3) analyzing and interpreting data; (4) linking data to classroom practice; (5) computer skills; and (6) collaborating around data. Brown et al. (2017) in their conceptual model combine data use and teacher inquiry and clearly indicate that teachers need scaffolding both in the research aspect of their inquiries as well as in working with data. Also, teachers' awareness of different technological tools which could be used for purposeful data collection seems to be limited. Ebbeler et al. (2016) also emphasize that teachers need additional support to be able to collect and use data from their classrooms.

The aim of the current study is to explore how 12 Estonian teachers perceive their own technology use and teacher inquiry (TI) practices, and how much this corresponds to reality. Also, how data-analysis skills satisfy their actual needs and what challenges they encounter within a technology-enhanced TI process. The study explores how teachers fall into different groups based on their skills and concerns connected with technology-enhanced TI.

2 Related Work

Teacher Inquiry (TI) has been identified as a powerful tool for teacher professional development and continuous improvement of teaching and learning (Mandinach and Schildkamp 2021). However, large-scale adoption of systematic evidence-informed TI has not become a reality despite multiple efforts to offer TI models (Hansen and Wasson 2016; Sergis and Sampson 2017) that would assist practitioners in the process. Specific barriers, especially related to teachers' data literacy competences, have been found to defer teachers from engaging with inquiry to improve their teaching practice. To alleviate these barriers and support teacher inquiry, versatile dashboards, systems and devices

have been developed, however, in addition to having sophisticated technologies and appropriate data, teachers must have some level of data literacy to use data effectively and responsibly (Mandinach and Schildkamp 2021).

Mandinach and Gummer (2016a) define teachers' data literacy as 'the ability to transform information into actionable instructional knowledge and practices by collecting, analyzing, and interpreting all types of data (assessment, school climate, behavioral, snapshot, longitudinal, moment-to-moment, etc.) to help determine instructional steps (p. 14).' They propose a conceptual framework for data literacy for teachers, consisting of five main steps: i) framing the question (articulating a problem and understanding the context), ii) using data (different types and from different sources, also understanding data accuracy and using technologies to support data use), iii) transforming data into information (generating hypothetical connections to instruction, understanding how to interpret data), iv) transforming information into a decision (diagnosing what students need, making instructional adjustments), and v) evaluating outcomes (re-examining the original question, considering the need for iterative decision cycles, monitoring student changes in performance, etc.). (Mandinach and Gummer 2016b).

As to decision-making, Light et al. (2005) present a framework linking data, information and knowledge, to demonstrate how raw data are made meaningful by relating the data to the context at hand. Wise and Jung (2019) propose a Situated Model of Instructional Decision-Making, which also divides the decision-making process into two: the sense-making step includes reading the data to get oriented, finding relative reference points, and explaining patterns; the pedagogical response involves either taking action, waiting to see, or reflecting on pedagogy, and checking impact. However, not much research can be found on how teachers actually follow these steps in their decision-making processes, and how they apply the knowledge of the classroom settings to the collected data. One good example of instructors' (at university level) use of analytics can be found in Li et al. (2022), where teachers' interpretations of analytics have been investigated.

Although educator experience and professional judgment are an important factor in teachers' decision making, for evidence-based decision-making these must be used in conjunction with data. The main task is fitting the pieces of the puzzle together to get a more holistic understanding of the context and inform practice going forward. Also, research finds that to facilitate and optimize students' learning processes and to consider learners' individual needs, effective data use requires the use of multiple sources of qualitative as well as quantitative data, and going beyond performance data (Lai and Schildkamp 2013; Mandinach and Gummer 2016a). As a next step, students should also be more often involved in the process of data use to enhance ownership, student learning, and student achievement (Mandinach and Schildkamp 2021).

The Analytics Model for Teacher Inquiry (AMTI) (Saar et al., in print) has been an attempt to synthesize TI and data use so as to provide practitioners with concrete examples and explanations on what to pay attention to in each step of the TI process. The data sense-making and interpretation steps in the model guide teachers to look for patterns in the data and then apply pedagogical knowledge to the extracted information to gain knowledge about the inquiry topic to inform decision making. The model also

emphasizes the link between data types and the inquiry question, and picking suitable technological options for the data-collection process.

It could be argued that teachers' modest technological competences might be another reason for low adoption of data-informed inquiries. For example, Estonia is considered an e-country and Estonian schools have good access to the internet and are fairly well equipped with computers, not to mention students' own devices. Therefore, it could be assumed that teachers at Estonian schools take advantage of technology in the teaching/learning process. What is the situation in reality and whether teachers also research the impact of technology use in their classrooms has remained unclear so far.

Also, most research into teachers' use of data focuses on automatically generated data from Learning Management Systems or different dashboards (Dawson et al. 2019). More specifically, the majority of studies use learners' online learning data to help teachers provide feedback or guidance. However, such data might not often correspond to teachers' actual needs. Obviously, to inform technology development, more research is needed to explore what data teachers would actually collect from their classrooms, how they would like the data to be analyzed and presented to them, and what insights they expect from these analytics. Teacher-lead data-collection from their own classrooms, however, is often limited to one data source at a time (e.g. assessment data or a student survey) and is very time-consuming and often difficult to analyze (due to lack of suitable data-analytics tools for multi-modal data).

In the light of the previously outlined problems, the current study explores teachers' sense-making and interpretation of teacher-collected data from their own teacher inquiry interventions, and how teachers' inquiry skills correspond to their perceived technological and technological pedagogical knowledge. To understand teachers' thought processes in TI, the steps in the AMTI are followed to document the inquiry processes of 12 teachers (from setting the goals to decision-making). Their use of technology in the process is also explored and their concern rates for TI calculated. The research questions defined for the study are:

1) To what extent do teachers' perceptions of their pedagogical, technological and TI skills correspond to their use of technology in the process of TI?
2) How do teachers make sense and interpret the data collected during TI?
3) How do teachers' implementation of TI relate to their concern levels about TI?

The contribution of our work lies in i) findings about technology-enhanced teacher inquiry, based on 12 iterative teacher action research cases; ii) establishing 'level groups' of teachers involved in TI, with the aim of demonstrating their different needs for assistance in TI.

3 Methodology

The paper describes a multiple case study design (Yin 1981), which was carried out within the Erasmus + Illumine project. Estonian school teachers, voluntarily participating in the project, conducted teacher inquiry action research (12 case studies for our research) for a whole school year. The Illumine project aimed at teacher professional

development - introducing evidence-based practices into teaching and promoting TI, as well as researching teachers' skills in using technology for teaching and TI. Therefore, it provided monthly 2-h online workshops for teachers, to introduce Science of Learning (SoL) strategies (Beardsley 2020) and technologies for applying these strategies. The aim was not just to try out evidence-based teaching strategies but also to conduct TI and assess the impact of these strategies on students' learning. Teachers were also supported with all the steps in their TI, were researched about their technological and TI knowledge and skills, and were involved in co-designing materials for other teachers who would be interested in SoL and TI.

All case studies followed a similar TI routine, however, the teachers could pick from different research-based teaching strategies an intervention they wanted to adapt or apply in their own teaching. The teachers worked in teams of 2–4 people to plan their interventions and implemented these either alone (at different schools) or in pairs (when they worked at the same school). Teachers were asked to document their TI in research lesson diaries, based on the AMTI (Saar et al., in print), which outlines eight TI steps (motivation for and purpose of the inquiry, inquiry question(s), data needs, data collection tools, sense making and interpreting of the data, and decision making based on the collected and analyzed data) and provides explanations and examples for teachers.

After individually analyzing their collected data, the teachers shared their experience in groups and got peer feedback. Most of the time, however, the feedback sessions consisted of 2–3 teachers sharing their practice while others had not had time to analyze their data and could not present. One of the reasons for poor data analysis was also linked to the pandemic time restrictions and absenteeism at schools, which greatly inhibited the possibilities for classroom data collection. However, listening to others' presentations inspired the teachers to continue with their own analyses and complete the intervention for the next workshop. Between the workshops, several individual online support sessions were carried out with some participants who required assistance or encouragement.

Sample: Twelve Estonian school teachers (Table 1) who participated in the Illumine project agreed to participate in the study and signed a written consent. It was also agreed that they would use the data collected from their own classrooms only for their own learning - to make sense of the new strategies applied in their teaching. Any data shared in the workshops and in this study was to be anonymized.

Table 1. The sample of the Illumine participants involved in the study.

Age:	Gender:	Work experience:	School level:	Subjects taught:
Under 30: 0	Male: 1	Up to 5 years: 1	Upper-secondary: 6	Languages: 8
30–49: 3	Female: 11	6–20 years: 3	Lower-secondary: 9	Sciences: 1
Over 50: 9		Over 20 years: 8	Primary, vocational & other: 3	Humanities: 4

Data Collection: First, to find out about teachers' perceptions of their technological and TI knowledge, an online survey was carried out based on the technological pedagogical content knowledge (TPACK) questionnaire (Schmidt et al. 2009). In addition to the 7×4 Likert scale (1–5) questions from TPACK, four additional questions about teachers' knowledge of the SoL strategies and four questions about their understanding of TI were included in the survey. However, as the present study focuses not on teachers' content knowledge but application of TI with the help of technology, our data analysis is centered around the pedagogical, technological and TI aspects of the survey only.

The survey was carried out prior to workshops, where teachers covered different SoL strategies and familiarized themselves with the steps in TI and technology use for teaching and data collection. The pedagogical knowledge (PK), technological knowledge (TK) and Technological Pedagogical Knowledge (TPK) mean scores (5-point Likert scale) were calculated based on the corresponding TPACK questions (Schmidt et al. 2009). Additional four questions about TI were added: with the help of technology, I consistently collect and analyze data about my students; Last month, using technology, I collected and analyzed data about my own teaching; I have sufficient pedagogical knowledge to make sense and interpret these data; I adapt my teaching decisions based on the evidence obtained.

To investigate teachers' actual use of technology in TI and to identify any challenges in the TI process, participants' research lesson diaries were collected. All in all, 18 research diaries of the first and second interventions were submitted by the 12 teachers. To ensure clear understanding of all the entries in the diaries, interviews were conducted with the participating teachers after the first TI intervention, where the teachers were asked to explain their TI steps using their research lesson diaries. Field notes from the interviews were added to the diaries by the researcher.

In the end, teachers' concern about TI was calculated using the Stages of Concern from the Concerns-Based Adoption Model (CBAM) (www.air.org), initially developed by Hall 1991, to calculate teachers' concerns, as change facilitators, about innovation in teaching. The twelve teachers filled out the 35 Likert-scale items after their second intervention (7 months after they had started TI in the Illumine project).

Data Analysis: For data analysis the present study employed mixed methods: descriptive statistics of the survey were compared to the results of qualitative analysis of research lesson diaries and the field notes from the interviews. Application of technology for teaching and data collection, as well as data types collected, were counted separately. Finally, the results from teachers' research lesson diaries were compared with their concern stages from the CBAM. The four phases of the data analysis were:

Phase 1: Content analysis (Schreier 2012) was applied to the 18 research lesson diaries (with field notes) based on the eight TI steps in the AMTI (Saar et al., in print). The initial coding frame was tested on the results of the first intervention and re-coded within a month for reliability. No changes were made to the coding frame when coding the second intervention results. Also, a comparison between the relevant data of the first and second iterations was conducted to detect any possible changes in the teachers' TI practice.

Phase 2: As the focus of this study was on the data interpretation steps in TI, the relevant sections of the research lesson diaries of all 18 interventions were analyzed

separately using inductive thematic analysis (Braun and Clarke 2006), to identify salient emergent themes (within these TI steps) with robust support. These were compared to the constructs from the AMTI to confirm or adapt the proposed data-analysis steps in it and to identify any new necessary steps that might emerge.

Phase 3: The descriptive statistics about each participant's perceived pedagogical, technological and TI knowledge were then compared with their actual use of technology and TI, apparent from the research lesson diaries (Table 2). Both success and failure in the use of technology and TI was detected, which led us to the understanding that teachers need different assistance in TI, based on their concerns.

Phase 4: The concern profile scores for each teacher were calculated using the methodology suggested in Hall (1991). The intensity of teachers' concern is indicated by the percentile score (the higher the score the more intense the concern). Then, the 'peaks and valleys' in the percentiles are identified to interpret the scores based on the Stages of Concern (CBAM): Unconcerned (0) indicates that a teacher's relation to the innovation (in this study TI) is not an area of intense concern as their attention is focused elsewhere at the moment. Information (1) shows interest in learning more about the innovation. Personal (2) stage is linked to the teacher's ability and role in facilitating TI (doubts, lack of confidence). Management (3) involves time, resources and energy necessary to facilitate TI. Consequence (4) pays attention to the impact of TI on students. Collaboration (5) indicates teachers' willingness to involve others in TI and coordinate TI facilitation. Refocus (6) expresses teachers' readiness and determination to promote and develop TI.

These data have been presented in two ways: data about each individual teacher (Fig. 1) and data about each concern stage (Fig. 2). As the scores are not absolute but rather relative to the other stage scores in each profile, they do not indicate the difference between the concern levels of different individuals but rather the concern for each particular teacher. Therefore, the shape of the profile is more meaningful than how high or low the score falls on the graph.

4 Results and Discussion

Table 2 provides the main findings from the TPACK survey and research lesson diaries of the interventions. The average scores for PK, TK, TPK and TI reveal that five participating teachers assessed their technological competences even higher than their pedagogical or teacher inquiry competences, although the difference is not big. However, the mean score for the perceived teacher inquiry competences of three teachers was three or below it. Does this mean that Estonian teachers are rather good at using technology but not so confident in teacher inquiry?

Table 2. An overview of the results from the survey and research lesson diaries.

	Survey data:				Data from research lesson diaries (a zero indicates a missed intervention):									
Legend	PK – pedagogical knowledge; TK – technological knowledge; TPK – technological pedagogical knowledge; TI – teacher inquiry knowledge				Inquiry questions (IQ): OK - the IQ is clear and measurable, matches the data; NR – initial IQ needed revision; M – missing.		Types of data (D) teachers collected: A- assessment; SA- self-A; PA – peer-A; O- observation; S- survey; M –mistakes.		Technology for teaching (TT): Q – quizzes; PP – pen & paper; Technology for data collection (TD): Q – Quizlet (vocabulary drill); GF – GoogleForms (surveys and self-tests); GS - GoogleSheet (for analysis); FN – ForgetNot (distributed recall); E- EduLog (engagement survey); NP - Nearpod (student answers and survey); V – videos; W - Wizer.me (digital worksheets).				Interpretations* (I): relevant and thorough process – 4 relevant but little interpretation – 3 attempted – 2 missing – 1 not relevant – 0 (no intervention carried out)	
Teacher	PK	TK	TPK	TI	IQ1	IQ2	D 1	D 2	TT 1	TD 1	TT 2	TD 2	I 1	I 2
T1	4.25	4.25	4	3.5	OK	OK	A, S	A, S	Q	Q, GF	V, Q	GF, GS	4	4
T2	4.25	3.75	4	4.25	OK	OK	A, S	A	Q, PP	FN	FN, PP	GF, GS	3	4
T3	3.25	4	3.25	2.5	OK	M	A	SA	Q	FN, GF	FN, GF	FN, GF	1	1
T4	3.75	2.75	3.75	4.25	NR	OK	A	SA	Q	FN	FN	FN	3	4
T5	3.5	5	5	4.75	OK	OK	M, PA	PA, S	PP	PP	V	GF	1	4
T6	3	4.75	4	3	NR	OK	SA	A, S	PP	PP	V	GF	3	3
T7	4.75	5	5	4.75	NR	0	A, O	0	Q	PP, Q, GF	0	0	1	0
T8	3.25	3	3	3.5	NR	OK	A	SA	Q	FN	FN	FN	1	1
T9	4.5	4	4	4.75	OK	OK	A	A, S	Q	GF	NP	NP	3	4
T10	4	5	4	4.25	0	OK	0	A, S	0	0	V	GF	0	4
T11	4.25	5	5	3.75	NR	0	A	0	Q	PP	0	0	1	0
T12	2.75	3.25	3.75	2.5	NR	0	A, S	0	Q	EL, W	0	0	3	0
All:	3.8	4.2	4.1	3.8	5 OK, 6 NR	8 OK, 1 M	3 S, 1 O, 11 A	5 A, 3 SA, 1 PA, 5 S	9 Q, 3 PP	8 tech., 4 PP	9 tech.	9 tech.	1 - 4, 5 - 1, 5 - 3	6 - 4, 2 -1, 1 - 3

Interestingly, two of the teachers who perceived their TK to be really high (4.75 −5 points out of 5) did NOT use technology in their first iteration at all. One used technology for teaching but not for data collection, and only one used technology both for teaching (quizzes) and data collection (quizzes and a survey). However, all other teachers applied technology for both teaching and data collection, even if their TK score was between 2.7 and 3.2. Also, all teachers regardless of their TK score used technology for data collection in their second iteration. This implies that even teachers who do not feel confident with technology can still find suitable technology for their needs and can benefit from technology-enhanced TI. It must be admitted that some teachers struggled with using new (for them) digital technologies and required assistance, but no one gave up. The gap between perceived TK and actual technology use is in line with the results of Schmid et al. (2020) study, where some (STEM pre-service) teachers who reported higher TK also had higher technology integration in lesson plans, but for some teachers (language and social studies) TPACK profiles were unrelated to technology use in lesson plans. The teachers participating in our study explained that pen and paper was often just more convenient to use (e.g. when access to digital devices needed prior arrangements).

The things were more difficult with teacher inquiry. One teacher skipped the first iteration in the project and learned from others' experience, although she participated in the planning phase. For others, the first apparent challenges emerged with wording the inquiry questions as, during the first intervention, only five teachers managed to develop inquiry questions for their intervention. Six failed in their initial attempt but were able to adjust the wording when guided to do so and did not have problems with the inquiry questions for the second iteration. The main issues connected with the inquiry questions (apparent from the content analysis) were: i) in the wording of the question (e.g.: 'How many words can be remembered?' when actually researching how free recall can help retain vocabulary in long-term memory) and ii) matching the inquiry question with the

data to be collected, e.g. when a teacher asked about student engagement but did not collect any data about it (just assessment). Similar difficulties have been pointed out also in Luckin et al. (2016), who noticed teachers experiencing difficulties with formulating narrow enough questions for their inquiry.

Classroom data collection itself did not pose many problems, except for some obstacles with technology use, which were overcome. However, the data analysis step seemed to be of a challenge as the teachers often did not find time/energy for it. So, six relevant data-analyses of the first iteration were initially submitted (only one of them was really thorough, which inspired others to try as well), but five teachers did not manage to do it within several months. However, most teachers got inspired and more confident about data analysis by the second intervention, when seven teachers analyzed their data (although it took 5–6 h for some teachers, which was considered too long) and five teachers finished the analysis of their first intervention.

So, in the end, the results demonstrate clear improvement in wording the inquiry questions, as in their second interventions all nine teachers (who attempted) were able to formulate a clear and measurable inquiry question. Although assessment data still prevailed, more surveys were carried out to get feedback from students about their perception of the class and material covered. An apparent change could also be detected in the use of technology for data-collection (no pen and paper during the second intervention) – this could be due to the inquiry topic of the teachers (four of them concentrated on reframing their students' academic stress mindset and, therefore, surveyed the students). It may also result from learning and collaboration – as the teachers shared their initial practices and planned the interventions in groups, following the steps in the AMTI, where technology use for data-collection has been suggested, their intervention plans for the second iteration were more detailed.

The content analysis of the research lesson diaries was aligned along the eight steps in the AMTI: first teachers' motivation and purpose, then the inquiry question, data needs and technology for data collection, and finally making sense of and interpreting the collected data for evidence-based decision making. The diaries and field notes reveal the following opinions and skills:

For **motivation** three categories were identified: the main driving forces for teachers to try out novel things and carry out teacher inquiry seem to be curiosity ('trying out new things and analyzing the outcomes'), willingness to improve and become more efficient ('better results with minimal effort'), and desire to provide students with better experience. As to their **purpose**, teachers mainly wanted to find out if students' motivation and results improve ('better retention') and if 'my gut-feeling and the theory about the teaching strategies match'. Initially there were some issues with **inquiry questions**, which were discussed with the teachers during individual interviews to help the teachers improve the questions. This yielded good results as the inquiry questions for the teachers' second interventions were all clear and measurable. Deriving from the strategies used in the Illumine project, teachers' inquiry questions could be divided into questions about retention of the material covered, learning from mistakes, overcoming fear (of testing/ public speaking), engagement and motivation.

In our study, teachers initially collected mostly assessment data, which is consistent with research findings about teachers' **data use** (Mandinach and Schildkamp 2021).

However, the interviews also provided possibilities for explaining which data sources could better suit the teacher's data needs to answer their inquiry questions. Unfortunately, assessment seems to be such an important aspect of school that all teachers in the second intervention still used assessment data. The only change that could be detected was that, in addition to assessment data, more teachers (5 out of 9 compared to 4 out of 11 in the 1st intervention) used several data sources (e.g. also survey data and observation). It also appeared that the teachers, though confident in their technological knowledge, did not always **use technology** when they might have. Some explained this with the distance learning imposed by the Coronavirus (too much screen time) and others with the 'convenience' of using pen and paper in the classroom (though manually collected data were rather difficult to analyze). However, as pointed out by Schmid et al. (2020) the mere use of technology itself does not indicate quality, rather it should be aligned with the purpose of the lesson. So, teachers' use of technology depends on many other aspects than only their TK and TPK.

Although initially four themes (patterns, explanations, conclusions and suggestions) emerged from the thematic analysis of the sense-making and interpretation step descriptions in the research lesson diaries, in the end they were still regrouped into the following two themes: patterns and reference points in data (results rising/falling, vocabulary longer retained), and possible explanations based on pedagogical knowledge and experience ('because self-tests worked as distributed practice', 'when 'common denominators' were used these helped to retain information', 'recall activities when assigned as home-work were often skipped'). This is consistent with the Data-literacy for Teachers framework (Mandinach and Gummer 2016a) and the AMTI (Saar et al., in print), which emphasize the multi-step approach to data analysis (from 'data' to 'information' to 'knowledge'). In earlier research (Saar et al. 2022) teachers have been identified 'jumping from data straight to conclusions', which might lead to misinterpretation of the data. So, using the AMTI as a guide might have helped teachers to avoid this trap in this study.

So, the **sense-making** step in the TI revealed that teachers are good at noticing student progress and recurring mistakes. All teachers noticed some improvement in their students' results or perceived higher engagement/motivation, although the teachers doubted whether these outcomes resulted from the new strategies used or other factors interfering with the intervention (e.g. Covid-time absenteeism hindered comparison of student results, excitement about participation in an experiment made students more willing to succeed, etc.).

When **interpreting** the collected data, the teachers could link their pedagogical knowledge to the collected data and explain the results. However, analysis of data from multiple sources (e.g. peer-assessment of public speaking and student survey about their stress level) was considered too time-consuming (taking 5–6 h) and teachers expressed the need for correspondingly assisting technology. The teachers also admitted that there were too many variables in the classroom and the results (e.g. student progress) might not always be due to the teaching strategy applied, but rather deriving from other activities (e.g. 'after getting bad self-test results a student might have changed to a different learning strategy then the one researched'). Teachers also repeatedly admitted that data collection became difficult as students were absent from classes at different times and this also hindered interpretation. It seemed to the teachers that their students became

more involved, however, it might have been due to the novelty of the new strategy (in the teacher's opinion) and more time would be needed to investigate this.

Decision making – the collected data helped the teachers reflect on student progress and adapt their own teaching methods and learning tasks. Teachers also reported being more aware of their own teaching and feeling satisfied with good results. Sometimes, however, the decisions that teachers made were not relatable to their inquiry question (e.g.: when researching how free recall helps longer retain new vocabulary, the teacher decided to increase the number of words that should be memorized).

In general, the results from both interventions reveal that teachers are good at finding patterns from the data – this step did not pose any problems in the research lesson diaries of the 18 interventions. All 18 included assessment data, which teachers are accustomed to use. In addition, changes in the perceived stress level (n = 4), vocabulary retention (n = 9), recurring mistakes (n = 3) and student engagement (n = 3) were explored, but not always detected. As to reference points, all teachers used some assessment criteria and comparisons between students.

Usually, teachers could come up with possible reasons for the results (deriving from their pedagogical knowledge). For example, they concluded that frequent testing (not assessed) improved results probably because it involved distributed free recall. Also, they were quite surprised that students' stress mindset could be reframed just by watching a video about 'stress enhancing performance'. However, the teachers noticed that this was true mostly about younger students, and concluded that older students were already familiar with the concept of 'enhancing stress'.

The post-workshop discussions also revealed that teachers gained more confidence to carry on with evidence-based practice and try out different research-based teaching strategies. The only concern was that the analysis of data from multiple sources (e.g., assessment and survey data) took too much time (5–6 h) and that is why some of the teachers did not find it possible to implement a second intervention. However, they were willing to continue with evidence-based practice if provided with technology that could ease the data-analysis step.

The main takeaways about teacher inquiry from the participating teachers were that:

- teacher inquiry should be expanded over a longer period (at least several months);
- in classes with fewer students it is complicated to carry out an inquiry involving several sessions (students are absent at different times);
- it takes time to adjust to any new strategy (so the data about the first time a new strategy is used might not provide a truthful picture);
- during an intervention, both the teacher and the students should be using familiar technology to avoid technical setbacks (that might hinder the effect of the researched teaching strategy);
- teachers require better overview of technology that could assist in data collection and analysis;
- teachers need tips on how to make data-analysis less time-consuming and how to present the analysis;
- TI also directly impacts students - they got excited to be able to participate in a teacher inquiry and showed higher motivation to progress;

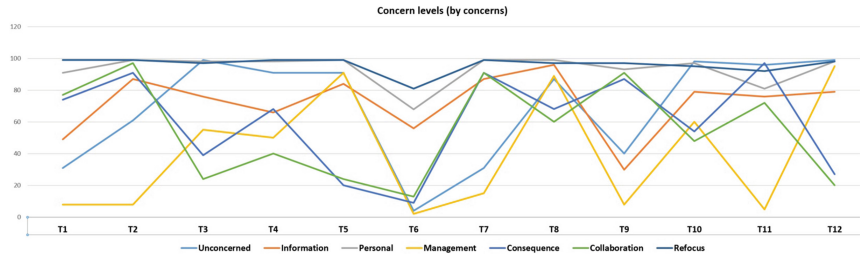

Fig. 1. The concern levels of teachers applying TI (by concerns).

Finally, to better understand teachers' concerns with their teacher inquiry process, we also administered the CBAM questionnaire (CBAM). The results (Fig. 1) show that refocus and personal concerns are relatively high among all teachers: 7 teachers have the highest concern (relative to their other concerns) about the refocus stage of TI (an expected result as they all voluntarily participated in the Illumine project, which focused on SoL and TI). The personal stage received the highest or second highest concern among 11 teachers, indicating concern about their own skills and role in TI, i.e. high willingness to improve and develop personal TI skills. The concern of six teachers (T1, T4, T6, T9, T10, T11) lies also with the impact of the TI on their students.

Four teachers (T 3, T10, T11, T12) have their highest scores in the unconcerned stage, which is indicative of their priorities being elsewhere at the moment. However, the concerns for information, management and collaboration did not get any highest score, and the concern for consequences received the highest score by one teacher (T11). As to the lowest concerns, six teachers demonstrate low concern for (time) management (which indicates that TI is less time-consuming than they initially predicted) and five are not concerned about collaboration and involving others (this being their lowest concern).

To identify groups of teachers with different concerns for TI, we should look at the highs of each teacher in Fig. 2. From this it becomes apparent that T2 and T7 could be described as having reached stage 5 or 6, as their main concerns are linked to collaboration and refocusing. Teachers 1, 6 and 9 would fall into stages 4 or 5 (their concern being mostly linked to consequences of TI on their students, as well as collaboration). Teachers 4, 10 and 11 represent stage 4 (consequence) and teachers 3 and 5 stage 2 (personal),

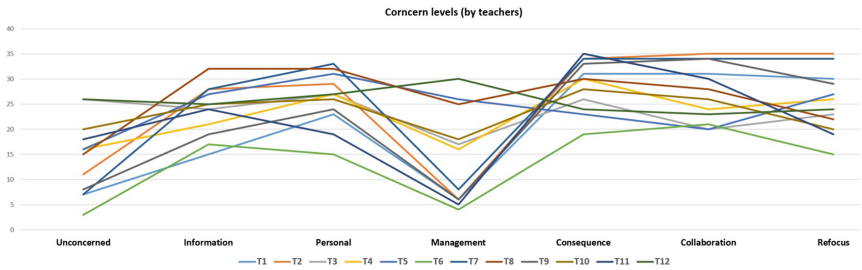

Fig. 2. The concern levels of teachers applying TI (by teachers).

while T8 is somewhere between stages 1–2 (needing more information and concerned about their own effectiveness in TI).

Table 3. The concern levels of teachers compared with their TI process outcomes (see Table 2).

Teacher	TI 1	TI 2	Concern stage	Decision (based on the concern scale and actual application of TI)
T1	4	4	4–5	The focus is on the impact of TI on students, and cooperation with others TI interventions show high command of data use
T2	3	4	5–6	The focus is on coordination and cooperation with TI interventions show high command of data
T9	3	4	4–5	The focus is on the impact of TI on students and cooperation with others TI interventions show high command of data use
T6	3	3	4–5	The focus is on the impact of TI on students and cooperation with others TI interventions show average command of data use
T4	3	4	4	The focus is on the impact of TI on students TI interventions show high command of data use
T10	0	4	4	The focus is on the impact of TI on students TI interventions show high command of data use when applied
T11	1	0	4	The focus is on the impact of TI on students TI interventions show low command of data use
T7	1	0	5–6	The focus is on coordination and cooperation with others TI interventions show low command of data use
T12	3	0	3	The focus is on time- and resource management TI interventions show average command of data use when applied
T5	1	4	2	The focus is on personal development TI interventions show improved command of data use
T3	1	1	2	The focus is on personal development (often hindered by lack of time) TI interventions show low command of data use
T8	1	1	1–2	The focus is on the need for more information and personal development TI interventions show low command of data use

When we compare the CBAM results with the teachers' success in applying meaning to their collected data during their TI interventions, the following trends become apparent (Table 3) (TI1 &TI2 stand for the scores of TI interpretation process from Table 2):

Teachers 1, 2 and 9 had highest concern linked to stages 4–6 and they also managed well with their TI and technology use both for data-collection as well as for data-analysis.

Therefore, we would group these three teachers as experts, who have acquired the necessary skills for TI and could focus on instructing and helping others. In our understanding, they can carry out TI on their own and also have demonstrated interest in continuing with TI topics.

Although the concern levels of two teachers (T6 and T7) would place them in the experts' group, their own TI still needs considerable attention (one could not work with data thoroughly and the other could only partially interpret the data). Therefore, we would group them together with T4, T10 and T11, as independent users, who would still be needing some assistance in TI (even if it were just finding time for proper data analysis). These five teachers have a good command of TI inquiry skills, however, either their disposition towards TI (the benefits still do not outweigh the efforts), confidence in their own skills (digital and technological skills), or other responsibilities (not enough time for data-analysis, which takes a long time as seen in the project) significantly hinder their TI adoption. Handy tools for data-collection and analysis would, hopefully, help them manage TI far more efficiently.

The third group (explorers) consists of teachers (T3, T5, T8, T12) who are focused more on the development of their own TI skills and would probably need different assistance with TI than the teachers in the previous groups. One assumption is that if the data-literacy competencies of these teachers improved or they could use supportive technologies, the teachers might be far better off with TI. However, this is a question for further research, which would need thorough investigation.

5 Conclusions, Limitations, Further Research

The study tried to investigate the match between teachers' perceived technological and teacher inquiry knowledge, and explored teachers' actual application of TI and technology within it. 12 Estonian teachers who participated in the 'Illumine' project carried out 18 teacher inquiries, testing novel (for them) teaching strategies. Despite some initial setbacks with inquiry questions, technology use, and time-consuming data analysis, all 12 claimed to have improved their TI skills, and used technology for both instruction and data-collection (though not always for analysis).

In general, the teachers understood the steps in their TI well, although documenting their thoughts was said to be challenging. Their own comments about their TI were enthusiastic - they were proud of their achievement (being able to carry out and document a teacher inquiry) and found some of the outcomes rather surprising. For example, not many believed that it would be able to reframe students' mindset about their academic stress just by watching one video. Teachers agreed that this strategy does not work with all students but even helping some students was seen as a good achievement.

All in all, the main problem areas in teacher inquiry seem to be connected with wording the research question and matching it with the data to be collected; also, more information and skills are needed to use technology, which would assist teachers in data collection and analysis. Another difficulty can be seen in data interpretation, i.e. applying pedagogical knowledge to the collected data, especially if the data come from different sources and about different aspects of learning (e.g. engagement and results). This indicates the need for devices that could help with the analysis of multi-modal data.

Based on their TI process and CBAM results, we divided the participating teachers into three broad groups based on their TI concerns: experts, who can work on their own; independent users, who still need assistance, especially in data-analysis; and explorers, who make their first steps and need more guidance than the previous groups.

In conclusion, it can be said that even when teachers are highly motivated in TI, they do not have enough skills and knowledge (or time) and, therefore, require assistance. Data-teams and other collaboration methods among teachers were seen as really helpful in this matter: 'it was good to discuss the results in a group – otherwise you just sit alone on top of the data'. Additional observations by the researcher are:

- for some teachers it takes longer to get used to the TI process: for example, some need a 'preparation time' - to observe others before engaging in an inquiry themselves, and for others it takes months to analyze their data;
- main progress could be detected in wording the inquiry question and matching the data types with it;
- teachers are good at using technology for instruction but are not used to applying it for data collection and analysis;
- data-analysis is too time-consuming at the moment, especially when the data come from different sources and need to be compared;
- the items about technological knowledge in the TPACK survey lack questions about the technological knowledge for data-collection and analysis;

The current study also has some limitations. First, all the teachers involved in the study had volunteered to participate in a TI project, therefore, they were all similarly interested in developing their TI skills and a study with a different set of teachers would probably yield different results. Also, as the inter-rater reliability could not be calculated, the reliability of codes was checked within a month by the same researcher. The internal validity of the study is supported by using a model (AMTI) for documenting the TI and assisting teachers with carrying out TI, however, there was no time to confirm the external validity, and this needs to be done in the future.

Lessons learned from the study that answer our RQs:

1. Teachers' perceptions of their pedagogical, technological and TI skills do not always correspond to their use of technology in the process of TI. However, this is more related to teachers' decision NOT to overuse technology than their competences.
2. Teachers use technology for instruction much more than for data-collection (or analysis) probably because they are not yet used to the idea and often the use of digital tools requires some pre-arrangement (as not all classrooms are equipped with digital tools).
3. Teachers' skills in TI improved during the seven months of participating in the TI project. The main improvement was in wording the inquiry questions, but also in working with data. The main obstacle is still lack of time for a thorough analysis.
4. Although it took some effort and explanations for teachers to understand how to apply pedagogical knowledge in data analysis, the teachers were usually good at identifying pedagogical reasons that could explain the data, and used two steps in data-analysis (probably because it was prescribed by the AMTI).

5. Based on their TI success and concern stages, we could divide the participants into three groups who would need different kinds of assistance with TI: the experts (confident on their own), independent users (need technology and tools) and explorers (who look for more information about TI and are concerned about their personal skills).

In the future, more research into the differences of teacher concerns in TI would be necessary, as the current study revealed possible level groups but the sample was really small and consisted of volunteers interested in the topic. Also, more technological support is required, especially when teachers use data from different sources. So, multi-modal TLA should also focus on teachers purposely collecting their own data and not relying on 'big data'. Teachers also require technologies for data-collection and documenting TI, to make the process less time-consuming. One solution could be advertising the existing versatile technologies (dashboards, apps, LMS, etc.) more among teachers and making them accessible for teachers' use. Another research line could be linked to exploring how students have been and could be engaged in TI processes.

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Digital Competencies

Developing the Evidence-Informed Digital Competence Assessment Instrument and Platform for Educators

Linda Helene Sillat(✉), Kairit Tammets, Mart Laanpere, and Pankaj Chejara

School of Digital Technologies, Tallinn University, Narva Road 25, 10120 Tallinn, Estonia
{sillat,kairit,martl}@tlu.ee

Abstract. Digital competence is considered as one of the key competences for active participation in the technologically fast-evolving society. Additionally, digital competence has become national-level indicators for implementing digital innovation in education, but there is a lack of common understanding on how to carry out methodologically sound digital competence assessment and how to motivate educators to assess the competence and reflect on their teaching practices. Digital competence assessment has been largely conducted externally by researchers or national agencies with different survey-type tools, so that respondents rarely own, re-use or revisit the collected data. Such an approach reduces the motivation of educators to use this data for continuous professional development (PD) purposes. The paper introduces an approach and a tool that potentially enables digital competence assessment with the focus on supporting professional development while combining different assessment approaches. The paper explores the results of expert group interview.

Keywords: Digital Competence · Evidence-Informed Assessment · Professional development

1 Introduction

One of the key objectives of the educators' professional development (PD) is the ability to engage with digital technologies [1] and facilitate the use of technologies with students. The European Framework for the Digital Competence of Educators (DigCompEdu) [2] is becoming a standard for educators' digital competence development, but also guides the educators towards reflecting on their competence levels and setting personal goals for PD. Quite often competence frameworks and related summative assessments are designed by the policymakers, the results are used for policymaking purposes on macro-level [3]. However, there is a strong need to support educators in building their agency regarding assessing internally and formatively their competence for their self-regulated PD purposes. It is not always clear how to systematically assess digital competence so that it would be also meaningful for the educators and the assessment results can be used as input for PD. Also, no consensus has been achieved on what is the most reliable way

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to assess digital competence and currently the self-assessment instruments is the most common approach used.

However, as Seufert et al. [4] have concluded, using the self-assessment scales may result in two types of bias: intentionally given inaccurate answers or a lack of ability to make a valid assessment. One of the suggested solutions to minimize the potential bias is to incorporate both summative and formative assessment characteristics in digital competence assessment [5]. In this article we aim to address the mentioned shortcomings and propose a solution for supporting educators in the guided development, formative assessment and certification of digital competence, which can be perceived as a useful process for their PD, while allowing administrators and policymakers to use the data for analytic purposes. The main research question of the paper is – what are the assessment instrument and platform technical development needs to support the educator's digital competence self-assessment process.

2 Digital Competence Assessment Experiences

Previous attempts in the same nature for building technological solutions to support the development of digital competence in the context of professional development have been in the works for the past ten years. Some examples include Opeka[1], which is a Finnish platform for supporting teacher, school management and government level assessment and analysis of digital maturity. The Swedish equivalent LIKA[2] focuses on both schools and kindergartens by offering an extensive digital competence assessment questionnaire for the teachers and school heads, enabling both individual and school-level changes. This is also supported by the implemented scale that focuses on development activities by dividing the process in stages – not planned but relevant, planned, started, almost there and achieved. Both of these solutions consider digital competence on an institutional level.

Alternatively, different European countries and organisations have taken the approach of assessing individuals' digital competence. In this case, both universal and field-focused (i.e. teachers and educators) digital competence frameworks are used to describe the central competence and scales. The Danish example Digital Competence Wheel[3] (2016) which acts as a self-assessment tool, focuses on providing an overview of digital competence in four categories (information, communication, production and safety) and provides instructions to support further competence development. The tool is loosely based on the European Commission produced DigComp [8] framework, which describes the digital competence of the citizen. Although the tool provides a clear overview of competence, it lacks the option to compare assessment results to previous attempts, meaning that it doesn't support continuous self-development. The French equivalent PIX[4] is a knowledge-based testing platform, namely for students to test their digital competence in five categories (information; communication and collaboration; digital content creation; safety; digital environment and problem-solving). Contrary to the Danish tool,

[1] https://opeka.fi/fi.
[2] https://lika.skl.se.
[3] https://digital-competence.eu.
[4] https://pix.org/en-gb/the-tests/

PIX focuses solely on problem-based assignments that derive from the practical use of technologies in everyday life.

In addition to the countries individual attempts of creating tools for digital competence assessment, there are also central solutions created by different European organisations. The European SchoolNet introduced Mentep[5] in 2015 to provide a more universal solution for assessing teachers' digital competence, thus the tool is in 18 languages covering the majority of larger European countries. The tool is similar to previous examples built on DigComp [8] framework, but introduces a more field-specific look on teachers' digital competence. In nature, it is a self-assessment tool that places self-reported statements in a 5-level scale, which are not presented in a scalable manner. After the pilot testing of the tool in Estonia it was considered as a down-side as there was no way to assure that when assessing their competence, the participants have also achieved the lower-level competence. Nevertheless, the tool provides a clear report of digital competence and options for further development. Additionally, it enables to compare the results with all other participants, countries average and with teachers' previous attempts. This can be considered as the first attempt on building the digital competence profile which supports continuous professional development.

Since the release of DigCompEdu [2] the European Commission has come out with two solutions for digital competence assessment, where one is focused on self-assessment and the other on knowledge-based testing. The latter is considered as the first basis of the tool described in this paper. The following will describe the design and development process of the tool.

3 Developing the Evidence-Informed Digital Competence Assessment Platform TINDA

To develop the platform and self-assessment instrument for assessing digital competence, the assessment framework was proposed in the first phase in collaboration with Estonian Education and Youth Board expert group. The expert group set out developing a universal digital competence self-assessment instrument and platform for Estonian educators in all levels of education. Educators and school heads from pre-primary, primary-, general-, secondary-, vocational- and higher education were included in the expert group who were included in the first round of development activities. The instrument and tool went through 4 iterations where both experts and educators were included in the validation of the items. The concept of a new online tool TINDA for self-assessment and development of educators' digital competence in alignment with teachers' qualification standard. The tool includes the item pool developed in the first phase and has two main components: assessment module and the PD module (see Fig. 1).

[5] http://mentep.eun.org/home.

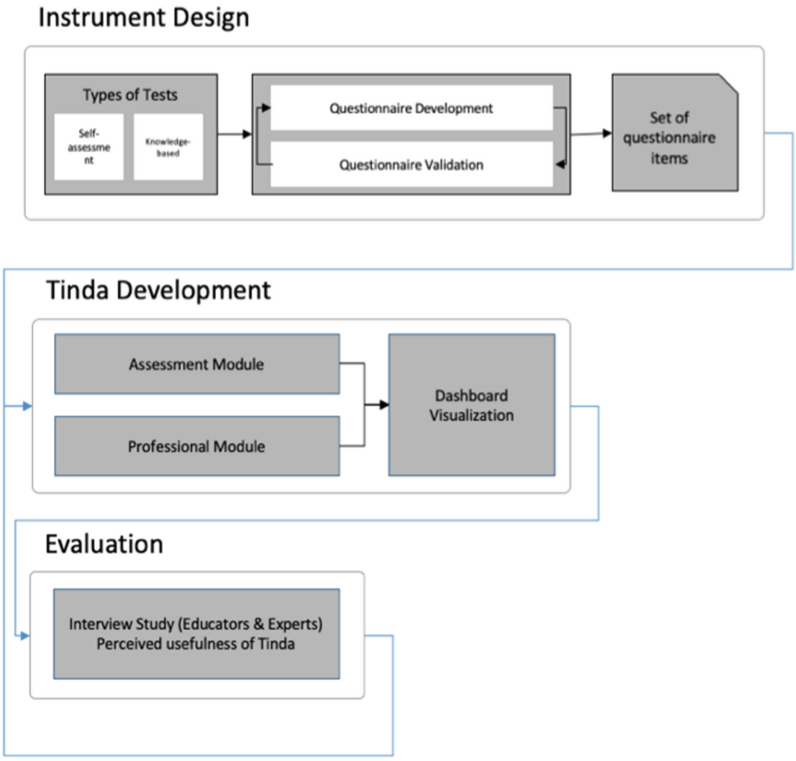

Fig. 1. TINDA concept

3.1 Assessment Module

The assessment module is designed to conduct assessment in two-stages. The first stage involves a diagnostic self-reporting scale, which will establish the educators' initial digital competence level. The process starts with self-assessment according to a set of competence claims, one claim per each of 22 dimensions in 6 domains. The six domains of educators' digital competence are defined in the DigCompEdu framework as follows: professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence. The diagnostic self-assessment is conducted on the following 6-point scale that was developed by an expert group in Estonia: **unaware** (no knowledge at all about it); **beginner** (I am aware, what it is, but I would need help to do it); interim level between beginner and expert; **expert** (I can do in independently on regular basis); interim level between expert and pioneer; **pioneer** (I can analyse, innovate, coach and lead others).

Based on the initial piloting, it was suggested that 3-point scale would not be enough and it should be expanded to include also level 0 and two interim levels for educators who are aspiring to the expert or pioneer level, but feel that they are "not there yet". The second stage of digital competence assessment in TINDA is the knowledge-based test to validate the self-reported assessment results from the first stage. There are 22 knowledge-based

test items, one for each of the DigCompEdu model competence dimensions. To save time and increase validity of the testing, the respondent will see only these items that address the lowest-scored competence from the first stage. This is considered as a summative assessment component in the competence assessment process. The knowledge-based test includes items on three difficulty levels - easy, moderate, difficult that are linked correspondingly to the 'beginner', 'expert' and 'pioneer' levels in the self-reporting scale. The test items are randomly chosen from an item pool consisting of 44 items to reduce the chance of memorizing the test. In the case that the initially offered items prove to be too difficult for the educator the system suggests lower-level items. Based on the two-stage assessment, a first competence profile will be produced which can be used as evidence in PD practices.

3.2 Professional Development Module

The PD module is developed to give the agency for the educators to develop their digital competence through data sense making for understanding the development gaps and monitoring and reflecting the competence development. The DigCompEdu framework is used to give the structure for the educators' PD where the defined indicators can be translated to the activities supporting educators' learning [3]. The aim is to embed the educators' competence development in their everyday practice. Proposed module in TINDA supports the educator to plan the PD based on assessment results and using classroom level collected data as an evidence of digital competence in the six domains. The module uses portfolio and evidence as artefacts to design pathways based on assessment results, which will reflect in the pedagogical model [6]. Added evidence is attached to the competence profile generated in the assessment module, meaning that the evidence can reflect on each competence dimension individually or present multiple competence dimensions. The full competence profile enables to plan, describe, make sense and present PD activities acting as a means for the formative assessment in the digital competence assessment process.

3.3 Visualisation of the Digital Competence Assessment Results

The majority of digital competence assessments are currently administered through survey-type platforms that do not provide the educator with a report of the assessment results [7]. One of the goals was to develop visualisations that support the educator to monitor their PD. The current version of TINDA provides three visualizations: results of digital competence assessment score in six competence domains; detailed view of 22-dimension scores; assessment results in comparison with the average of other educators. The aim of the dashboard is to establish a feedback loop that would help the educators to analyse their competence and improve their pedagogical practices.

4 Methodology

To understand the suitability of the proposed digital competence assessment instrument and TINDA test delivery system usability we carried out a group interview with experts

by implementing Nominal Group Technique (NGT) [9]. The expert group included educators from different levels (pre-school, basic-, secondary education) and educational technologists who had a higher understanding of supporting the development of digital competence and software development. The study was carried out in Spring 2021.

NGT was implemented involving critical reference groups in successive phases to understand the development needs of the digital competence assessment instrument and platform. Based on the NGT the session was divided into three phases (Fig. 2) – (1) individual suggestions, (2) group discussion and merging the items and (3) ranking of the items. As an output a finalised ranked list of items was produced.

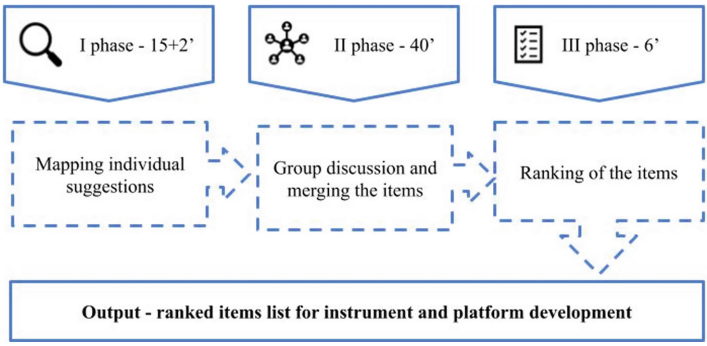

Fig. 2. NGT successive phases

The research focused on the first stage of the assessment module in TINDA where the experts tested the diagnostic self-assessment instrument. Before the NGT session, all participants were asked to create an account on TINDA platform to test the overall usability and fill-in the digital competence self-assessment questionnaire to understand the instrument and process.

During the first phase of the NGT session the participants were asked to map their ideas in 15 min in two main categories – instrument/questionnaire and platform usability/technical needs. Additionally, the category for miscellaneous ideas was included to map the statements that did not fit into any of the fixed categories. The participants asked for additional time, which added 2 min to the first phase. After that, all proposed statements were discussed, similar statements were merged and the participants had a chance to explain their ideas where necessary. The second phase was the longest lasting 40 min. The final phase of the session ran for 6 min where the participants ranked the remaining statements in a 10-point scale in the order of importance, where 1 was not important and 10 the most important.

4.1 Data Collection and Analysis

Data collection was done using the online brainstorming platform - Padlet software, and all results were exported in csv file format. Overall, there were 27 statements in two main categories and 1 in miscellaneous category - expected completion time of the

questionnaire, which was moved under the instrument category during the second phase of the session. After that average rankings of the statements were calculated and the two categories were sorted sequentially based on the rankings.

5 Results

By analysing the NGT session results in two main categories we aimed to investigate the redesign conditions of the digital competence assessment instrument and the design and development needs of the TINDA platform.

5.1 Assessment Instrument

The self-assessment instrument includes a 6-point scale: unaware; beginner; interim level between beginner and expert; expert; interim level between expert and pioneer; pioneer, where the scale is introduced in the title section of the questionnaire. All participating experts stated as the highest-ranking instrument development need (average 10 out of 10) that the scale explanations should be visible throughout the question sections because of the complex descriptions of the scale statements. They also ranked an average of 6 out of the 10 that in multiple cases it was difficult to distinguish the difference between expert and pioneer, meaning that the scale needs further explanations. Additionally, they pointed out that the questionnaire included items which consist of multiple measurable constructs and is impossible to assess equally based on the assessment scale. This was ranked an average 10 out of 10 and participants stated that the scale statements need further elaboration.

Equally important was the fact that when entering the questionnaire, it is stated that the expected completion time is 180 min which in participants sets unrealistic expectations as in reality the completion time is no more than 40 min. Additionally, it lowers the motivation to attempt to fill in the questionnaire before further investigation. The participants also stated that as the instrument is based on a central European framework, they would like to have a link or further reading possibility.

One of the main strengths of the instrument was the division into sections (average 9 out of 10). Based on the DigCompEdu model the instrument is divided into 6 item sections - professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence, and presented in the platform accordingly. At the same time, all participants stated (ranked average 10 out of 10) that navigation between item sections should be added to better understand the cohesiveness of the questionnaire items. They also suggested adding an automatic save function or a *"save"* button to every section to enable the users to leave the questionnaire pending and return later.

Participants ranked an average 5 out of 10 the need to include a dictionary to the questionnaire to better understand the item wording and used definitions. It was suggested to extend or connect the platform to an already existing dictionary used in explaining digital education to avoid repetition and discrepancies in the educational setting.

Although the overall feedback to the instrument varied, it was still concluded that it is suitable for the Estonian general education setting and supports educators in defining

their level of digital competence. The main development needs are the scale redesign to clarify the statement descriptions and reviewing the items to eliminate multiple measurable constructs.

5.2 Platform Usability

The overall visual and use of colors and fonts was ranked an average 8 out of 10. At the same time, the highest-ranking technical need (average 10 out of 10) of the platform included the language of the platform and command function placement. TINDA platform currently supports testing and self-assessment in eight European languages, where the main landing page is in English. The participants stated that because the page settings are in English the general commands, like "next" and "finish" are presented in English although the self-assessment questionnaire is in Estonian. They also brought out that when switching the entire platform into Estonian, the questionnaire is no longer visible for the users. The overall suggestion was to include a location-based service so the dashboard would be presented in the users' local language where possible. They also pointed out that the command functions were placed randomly on the platform which complicated the process. It was suggested (average 8 out of 10) to include the command functions on the bottom of the page.

In parallel, the participants brought out that it is crucial (ranked 10 out of 10) to include either a downloadable report or a visual representation of the results for the user. They stated that instead of the current placeholder note thanking the user for filling in the questionnaire, it could include a general aggregated data document in a table format. In multiple cases, the participants pointed out that they would like to use the results as a basis for planning their professional development. Additionally, it was suggested to add a section for comparing questionnaire round results and map the development process.

Three of the participants accessed the platform and filled out the questionnaire in iOS supported mobile devices and stated that the overall usability was great. This highlighted the need to test the user interface in mobile devices supported by different operating systems. Additionally, the participants stated that it is important to review the entire mobile standard of the platform and review privacy settings, including the registration. Participants ranked an average 9 out of 10 that the registration via email worked but they would have preferred access without compulsory verification. They suggested adding the verification as a mandatory step before accessing tests and questionnaires. It was also pointed out that registration using other authentication solutions, like Facebook or Google, should be added.

6 Discussion and Conclusions

This study introduces the first phase of the research which aims to develop the digital competence assessment service that includes the elements of diagnostic, summative and formative assessment. We claim that such approach will increase the validity and reliability of the digital competence assessment, which is important input for teacher trainers and policymakers responsible for planning the trainings. Additionally, it will support the professional development planning and activities for educators.

The inquiry about the technical implications of an evidence-informed digital competence assessment platform gave an overview of the order of development activities. The main digital competence self-assessment related development need included better structuring of the assessment scale by including more elaborate level descriptions. Additionally, it was suggested by the experts to review the items to eliminate multiple constructs within one item. It was also pointed out that the questionnaire should include a reference to the digital competence framework DigCompEdu [2] and dictionary to better understand the used concepts in the instrument.

Our study results illustrated that digital competence assessment should be embedded in the professional development activities to support the meaning for assessing and developing educators' digital competence. Competence development process should be a holistic process, where the educator plans the development, collects data about own teaching and learning and monitors the development.

Due to the fact that all participants included in the study are considered as expert educators we cannot generalize whether the TINDA solution is suitable for the average educator as well, thus it can be considered as the main limitation of this study. Furthermore, in addition to a focus group approach the platform needs further validation via piloting in the authentic setting.

After the improvements, the next step is to pilot the complete evidence-informed professional development logic behind the TINDA platform with pre-service and in-service teachers to understand the underpinnings of the process. Furthermore, the tool should be implemented systematically into the pre-service teacher training to understand the implications which may rise during the total period of studies. This includes mapping the course learning outcomes with DigCompEdu model and designing the evidence system within the courses.

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Training Digital Competences of Educators in Continuing Education: A Three-Level Approach

Jue Wang Szilas and Patrizia Birchler Emery(✉)

Centre for Continuing and Distance Education, University of Geneva, 1211 Geneva 4, Switzerland
{Jue.WangSzilas,Patrizia.Birchler}@unige.ch

Abstract. The Centre for Continuing and Distance Education (CCDE) of the University of Geneva has initiated and experimented the segmentation of their supporting service in terms of digital transformation of continuing education programmes as well as staff training with a "Three-Level" solution, consisting of the "easy option", the "intermediate option" and the "advanced option". Guided by the Design-Based Research approach, we have not only redefined the objectives for each option but have also improved the staff training from only workshop-based format to self-assessment plus workshop format. In this article, we present the two design cycles of the "Three-Level" digital transformation as well as the digital competence training model in detail and share several concrete examples for staff training.

Keywords: Digital transformation · Digitalization of higher education · Digital competence · Teacher training · Design-based research · Lifelong learning · University continuing education

1 Introduction

The digital transformation of university-level continuing education has become more and more urgent, not only as a solution for the pandemic situation but also for its sustainable development. Well-designed e-Learning programmes can provide learners with more flexibility and a personalised learning experience. However, several challenges arise. For example, the time and human resources allocated to help develop the online learning materials, the scenarios to meet disciplinary requirements, and the teachers' and the students' technological affordance (digital skills). Digital transformation of the courses is thus an important and essential process that needs to ensure the quality of the courses offered in terms of content, learning environment and support.

1.1 Institutional Background: University Continuing Education in Switzerland

In Switzerland, the universities and federal institutes of technology are responsible not only for the initial education of students, but also for the continuing education of university graduates and those who are interested in scientific fields, thus making the results

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of university research accessible to the public and, at the same time, combining knowledge with professional practice.[1] Indeed, as individual training can never be considered definitively completed, the renewal of professional expertise through lifelong learning is the only way for professionals to remain competitive in his/her field.[2] The universities, as leading educational and research institutions, ensure the quality of university continuing education offers. The continuing education programmes are carried out in accordance with the Recommendations for the Quality Development of Continuing Education Programmes developed by Swissuni, the Association of Swiss Universities Continuing Education, in partnership with the Swiss Agency for Accreditation and Quality Assurance (AAQ). They meet the requirements of national and European quality assurance frameworks.[3]

The Continuing education programmes take the forms of the following higher education degrees: Master of Advanced Studies (MAS – 60 ECTS), Diploma of Advanced Studies (DAS – from 30 ECTS on) and Certificate of Advanced Studies (CAS – from 10 ECTS on). There are also short programs, or modules, which don't award a degree, but only a certain amount of ECTS (from 2 to 6–7). The awarding of ECTS credits in continuing education is in accordance with the European Higher Education System and the ECTS recommendations of swissuniversities,[4] and thus guarantees the transparency and comparability of diplomas.

Diploma courses are targeted at people with a university master's or bachelor's degree and professional experience. However, some courses are open to people who do not have a university degree but equivalent qualifications and professional experience. Admission requirements are clearly set out for each programme.

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[1] Swiss continuing education and training (CET) is very diverse: the spectrum of providers ranges from small private schools, public providers, associations, or trade unions to micro-enterprises, learning studios and independent trainers to large enterprises financed privately. In absolute figures, private providers clearly dominate the picture: they provide around 80% of the total number of teaching hours, whereas public providers – above all universities, universities of applied sciences and VET schools – offer about 20% of CET hour. The CET programmes can have many different formats, depending on the skills, profession, public and provider involved (https://alice.ch/en/continuing-education-in-switzerland/, last accessed 2022/03/02).

[2] Cf. EUCEN's definition of University Lifelong learning: "ULLL is the provision by higher education institutions of learning opportunities, services and research for: the personal and professional development of a wide range of individuals - lifelong and lifewide; and the social, cultural and economic development of communities and the region. It is at university level and research-based; it focuses primarily on the needs of the learners; and it is often developed and/or provided in collaboration with stakeholders and external actors" (EUCEN: European University Continuing Education Network: http://www.eucen.eu/aims-and-objectives/, last accessed 2022/03/02).

[3] Swiss University Continuing Education Quality framework: http://www.swissuni.ch/qualite/, Swiss Agency for Accreditation and Quality Assurance: https://aaq.ch/en/, quality label in Swiss Adult Education: https://alice.ch/en/services/eduqua/, AMBA: https://www.associationofmbas.com/about-us/, last accessed 2022/03/02.

[4] https://www.swissuniversities.ch/fr/themes/enseignement/bologne-20-ans/reforme-de-bologne/ects, last accessed 2022/06/03.

1.2 Continuing Education at the University of Geneva

The Centre for Continuing and Distance Education (CCDE) of the University of Geneva works alongside with the University's faculties for the development of lifelong learning programmes. The CCDE accompanies the process of creation, development, promotion, management and evaluation of the continuing education programmes and ensures the implementation of quality principles and accreditation requirements. One of its roles is to make sure that the staff in charge of each programme has the tools, resources and innovative approaches they need.[5] The CCED's Learning, Programme Development & Partnerships Section is responsible for instructional design and pedagogy, in particular the digital transformation of the programmes and the training of the teaching and coordination staff.

By the end of 2021, the University of Geneva has run 344 continuing education programmes, i.e. 87′443 teaching hours and 9′600 students.[6] The teaching and administration staff of these programmes include University professors and lecturers, practitioners and experts from the workplace, programme coordinators and/or tutors, whose digital competence level vary considerably, specifically concerning distance teaching tools and pedagogy.[7]

Furthermore, the teaching team undergoes significant changes from year to year, thus constantly reconfiguring their digital competence profile. This requires the constant engagement of teaching staff and the instructional designers of the CCDE to update their skills. The CCDE therefore launched its first project in 2018, seeking to define the digital skills of teaching staff for continuing education programmes and build a self-assessment test, and then to provide a personalised training courses with video tutorials.[8]

The project targeted basic pedagogical skills and the use of learning management systems, as well as other information technologies. The University of Geneva has set up a digital transformation office and defined its digital strategy in 2019. The project was then taken over by the IT department. Its main focus was to strengthen students' digital skills[9] in the various areas listed in most of the existing digital competency frameworks,[10] namely information and media processing, content creation, communication and collaboration, digital resource management, security, etc. In the second stage, the University will provide self-assessment tests and e-Learning training modules for teachers. As for administrative staff, the training is planned to be taken forward at a later stage. The CCDE has therefore concentrated on more practical objectives, aiming to achieve more immediate results and to keep pace with the digitalisation of higher education, particularly in the area of teaching and learning.

[5] https://www.unige.ch/formcont/en/about/role/, last accessed 2022/06/03.

[6] https://www.unige.ch/formcont/a-propos/chiffres-cles/, last accessed 2022/06/03.

[7] The number of teachers may vary from year to year so it is difficult to give the exact number. We can estimate that the total number of both teaching and coordination staff involved is around 400.

[8] https://ciel.unige.ch/2019/05/realiser-un-referentiel-pour-les-competences-numeriques-des-enseignants-et-coordinateurs-de-formation-continue/, last accessed 2022/06/11.

[9] https://makeiteasy.unige.ch/index.php, last accessed 2022/06/11.

[10] https://www.unige.ch/numerique/archives/competences/referentiel-de-competences-numeriques/, last accessed 2022/06/11.

Actually, the digital transformation of continuing education programmes at the University of Geneva dates from well before the COVID pandemic and its catalytic effect on distance learning. Indeed, the public target of the continuing education programmes is mainly composed of working professionals for whom greater flexibility and autonomy in the learning process constitute a real added value, enabling to avoid the multiplicity of trips with their resulting costs and waste of time.

For this reason, since 2015, the CCDE has introduced a real dynamic of digital transformation, not only for the new programmes, but also for those already in place. Such a transformation also allows to rethink a programme and to implement an effective learning design. The CCDE provides tailored consulting services, technical support as well as staff training to help this transformation.

When the University of Geneva decided in 2018 to replace the Chamilo platform with the Moodle platform, the CCDE's Learning, Programme & Partnerships Section had to develop a strategy to facilitate this transition. The strategy could also be applied to the digitalisation of programmes in general, as many of them began actively looking for more appropriate or advanced ways to develop distance learning. We were faced with two major challenges: on the one hand, we needed to identify and/or classify the different programmes according to their specific requirements and on the other hand, we had to rethink staff training.

2 Three-Level Model: A Project with Design-Based Research Approach

To find an efficient way to support the digital transformation of the Continuing Education Programmes and to enhance the digital skills of the teaching and administration staff, the CCDE has initiated and experimented a "Three-Level" solution, for both digital transformation and staff training. We have adopted a DBR approach to develop this model. In this part, we will present briefly the DBR approach and the two design cycles.

2.1 Design-Based Research Approach

Design-based research is a research methodology approach used by researchers and practitioners in learning science, aiming to develop solutions to problems. Wang and Hannafin [12] captures its critical characteristics:

"a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (p. 6).

According to the Design-Based Research Collective [3], a project with typical characteristics of DBR should include these elements:

- Its goals are solving current real-world problems.
- The researchers and practitioners (can be the same people) are fully involved in the project.

- It is contextualized because research results are related to both the design process that produced the results and the environment in which the research was conducted.
- The design interventions are continuously refined to make them more applicable to practice.

As presented by Collins et al. [2] and Reeves [8], the DBR approach usually goes through four steps:

1) Analysis: The researchers identify a problem that needs to be addressed;
2) Design: They develop a potential solution, usually in the form of an instructional tool or model that could solve the problem;
3) Testing and Refinement: They test the instructional tools or model in a real-world setting and refine it to get better result;
4) Evaluation and Reflection: The researchers reflect on the outcomes of the experiment, identifying the features of the instructional tools that were successful at addressing the initial problems, revising those aspects that were not helpful to learning, and determining the design principle. This leads to another research cycle of designing, testing, evaluating, and reflecting to refine the instructional design in support of learning. The iterative process can be characterized in the figure below after Reeves [8].

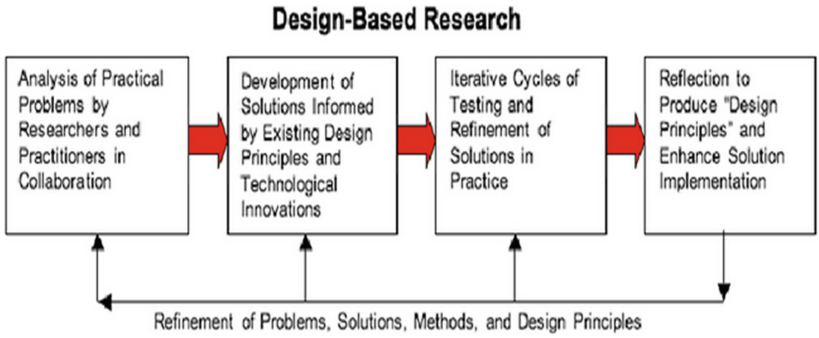

Fig. 1. Predictive and design-based research approaches in educational technology research (Reeves [8] p. 59)

Similar to the design-based phases presented by Scott et al. [11] and Pool and Laubscher [7] in the form of micro-, meso- and macro-cycles, the "Three-Level" solution has gone through the four steps during two Design Cycles from 2019 to 2022, presented in detail in the following part.

2.2 Design Cycle 1 (General Webinar Followed by Three Workshops)

The first Design Cycle lasted from 2019 to 2020. The focus of this Cycle was the refinement of the "Three-Level" transformation model and the digital competence training workshops to support its realization.

Identification and Analysis of the Problems. Since 2018, the CCDE has organised or co-organised several workshops with the e-Leaning Unit of the University of Geneva to train the staff with necessary digital competencies, in particular the basic Moodle skills. However, the workshops proposed for all the University staff were more knowledge-based than skill-based, hence there was not enough time for the participants to practice. It was thus difficult for the participants with no or less pre-requisites to benefit fully from the workshops. This "skills gap" among the participants also brought some difficulties for the training organizers as they were constantly interrupted by the "beginners". What's more, most of the coordinators who take charge of the administrative issues and the setting up of the course content to Moodle platform have neither teaching nor instructional design experience, which limited their potential in supporting the digital transformation. A basic pedagogical training seemed necessary for them.

Design. Under this context, in order to help the whole continuing education staff, regardless of their knowledge and skills on Moodle and to set up a course on Moodle platform that was at least well-structured with some interactivity, we developed three transition option models.

This concern to enable an effective transition despite the varying levels of digital skills of staff members has remained at the core of our work to improve and transform our model. Depending on the requirements and needs of each module/course we proposed three techno-pedagogical options for the e-learning implementation on the Moodle platform: easy, intermediate, and advanced:

- The easy option is the first step towards transforming a classroom-based course/module into an e-Learning format. It enables teachers or coordinators to deposit, organise and share the teaching resources on Moodle platform.
- The intermediate option allows, in addition to structuring the teaching resources, to design a scenario for a course/module with clear task instructions and supporting videos so as to guide the learning process.
- For those who wish to go further, the advanced option allows building a personalised learning journey for students. We encourage the teaching staff to choose this option if time and budget allow it and help and accompany them to realise the learning design.

As digital solutions changed, then staff training needed to change accordingly. We thus proposed a three-level workshop model solution aiming to train the continuing education staff with digital skills on using Moodle platform at different levels. This included a general webinar (during the Covid period) and three workshops: easy, intermediate, and advanced. The general webinar, entitled "transformation of a continuing education programme from face to face to distance learning" was open to all the CCDE teaching and coordination staff. The webinar was knowledge and information based, aiming to help the participants to be familiar with the strategic and theoretical dimensions and with the key operational aspects of the digital transformation process (scenario designing, different actors, different tasks, different skill requirements, etc.). It was intended to help participants to identify which level of transformation was most appropriate for their programme. At the end of the webinar we informed them with the following three-option

"hands-on" workshops to guide their choice. The objectives and learning outcomes are presented in detail in the table below:

Table 1. Objectives and learning outcomes of the three-level workshop model.

Workshop	Objectives	Learning outcomes After the workshop, the participants can	Tools
"Easy option"	To deposit and organise teaching and learning resources	- Log in Moodle and create a course space with a brief course introduction - Enroll participants with different roles - Upload different types of pedagogical resources and share them with the participants - Organise these resources appropriately with sections - Create an assignment	File, Folder, Enrolment, Assignment, Quiz, Announcement
"Inter-mediate option"	To build a guided self-directed learning with synchronous or asynchronous tutoring	- Produce a learning guide with the template provided - Use one or two Moodle tools to script the course content - Moderate forum discussion - Use a wider range of settings for the learning activities (Quiz, Assignment) - Set groups for different learning activities	Page, Book, Forum, Quiz, Assignment, Group
"Advanced option"	To build a customised learning journey and enhance interaction and collaboration between learners and teachers	- Scenarise the course content with a specific tool - Create peer-reviewing activity with Workshop - Use Forum for communication and evaluation - Manage learning activities with Group and Grouping	Lesson, H5P, Workshop, Forum, Group and Grouping

Testing. A first adaptation took place in 2020, integrating the synchronous distance learning tool Zoom. We refined the three levels of transformation with different uses of this video conferencing tool. Following this adaptation, we proposed practical workshops to the staff members and collected their feedback, which revealed and confirmed that the development of their digital skills at different levels should be central for an effective

digital transformation and not vice versa. The three "hands-on" two-hour workshops have been organised via Zoom during March 2021 with the following agenda:

- 30 min: Presenting the option with the skills to be worked on and concrete examples
- 15 min: Collecting the participants' questions
- 60 min: Practising in small groups with a CCDE techno-pedagogist
- 15 min: Feedback

Evaluation and Reflection. About fifteen participants took part in the workshops, including teachers and coordinators. The general feedback from the three workshops was very positive with an explicit request to organise them regularly. All participants admitted that the "learning by doing" workshop allowed practical problems to be solved on the spot, which was more specific and effective. They appreciated the engagement of both the coordinating and teaching staff in the workshop because it helped them understand each other's roles and make their collaboration more efficient. However, a gap in digital skills regarding basic Moodle skills and advanced skills with certain tools was observed among the participants.

The workshops allowed us to observe directly how the participants applied the skills and thus to target more precisely their needs and difficulties. For example, some basic skills like uploading a file or adding a picture to a document seemed to be big problems for some participants with limited digital skills. We also noticed that the skills-gap was a big barrier for the techno-pedagogists in accompanying the practising part of the workshop, for he or she should stop to explain these basic things before going to the next step, which can be solved simply with tutorials. Although the workshops have received very good feedback, the number of participants has been very limited. This is partly because such a workshop requires the intervention of a techno-pedagogist who cannot coach more than three participants at the same time, and, partly because the timing may not suit all those who need the training.

2.3 Design Cycle 2 (a Self-paced Online Learning Module with Intermediate and Advanced Workshops)

The feedback allowed us to reflect on a reorganisation of the workshops with more targeted objectives and more suitable formats. From May to October 2021 the model was therefore redesigned, this time focusing more on the skills needed to achieve online courses that meet the standard quality level required in our continuing education programmes. We have transformed the three options into a new version:

- An online self-training based on tutorials as an entry threshold for all continuing education staff, which not only solved the "skills gap" problem, but also allowed more people to participate and to have a prerequisite to go further,
- A standard workshop to ensure the quality of the transformation of the continuing programmes in general, and finally,
- Several advanced workshops to develop specific skills.

The self-training course "Threshold option: basic skills to be mastered", entirely online and self-paced, aims to provide all staff members working for the continuing education programmes with the basic knowledge and skills of Moodle: 1) Savoir: basic notions of pedagogy; 2) Savoir: basic Moodle concepts 3) Savoir-faire: getting started with Moodle; 4) Savoir-faire: registration and managing participants; 5) Savoir-faire: communication via Forum; 6) Final exam: from theory to practice. The estimated time for the module is around 5 h, depending on the general digital skills of each participant.

From November 2021 to February 2022 we invited 31 "active practitioners" to test the online course. The invited participants should finish the online course and sit the final exam. Once the exam completed, our team's experts would evaluate their work and give them feedback. A badge would be delivered to those who succeeded the exam. More than half of the participants have started learning the module, though only six have finished the exam. However, we got a lot of feedback about how to ameliorate the content of this module. Based on the feedback we have refined the design and will launch the training for all the CCDE staff in September 2022.

3 Discussion and Further Development

From the DBR process of the Three-Level model we can bring about more general design principles that can be adapted by other similar projects, for example, the training proposed by other units of CCDE or other similar services of the University of Geneva or even for other institutions with similar context.

We had the idea of developing the self-paced "Threshold option" course content with gamification, to make the training more fun. However, due to lack of time and resources, we had to put the priority on content development in the first place, which leaves space for improving the course content with gamification.

We see also another potential to develop the self-paced "Threshold option" course as a Micro-credential, which can, on one hand, value and valid the participants' learning outcomes with an institutional recognized badge if they succeed the final exam and, on the other hand, provide them opportunities to have an online continuing education experience before designing an online continuing education programme. To achieve this, more work should be done in the future to refine the design, in particular the assessment methods, and to obtain the institutional support.

Finally, in the wake of the Covid-19 pandemic and the spread of distance learning, there appears to be a need to integrate the upskilling of teaching staff into the overall digital transformation of educational programmes. Not only does it help us to better assess the impact of the three-tier model, but also it can lead to a global reflection on the normalisation of distance education.

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DigComp Helping Shape the Education Ecosystem in Europe

Riina Vuorikari(✉)

Joint Research Centre – European Commission, Calle Inca Garcilaso, 41092 Sevilla, Spain
Riina.Vuorikari@ec.europa.eu

Abstract. The Digital Competence Framework for Citizens (DigComp) provides a common understanding of what digital competence is and can thus support curriculum planning, instruction and assessment both at EU level and in Member States. Additionally, a reference framework such as DigComp can be a tool to support policy-making and monitoring (e.g. setting targets for digital up/re-skilling) and certification processes. All these components are integral parts of education ecosystems (e.g. curriculum planning, assessment, certification, policy-support). In this paper, a number of examples will be given and it will be argued that especially when digital transformation is shaping education ecosystems in Europe, common reference frameworks can support education actors to collaborate, share good practices and learn from one another both within a country and across them. This contribution first outlines the DigComp 2.2 update and then focuses on the uptake at EU level and in Member States.

Keywords: Digital competence framework · DigComp · Reference framework · EU · Digital education ecosystem

1 Introduction

Within the EU, digital competence is defined as follows: "*Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.* [1]".

Moreover, the same document, Key Competences for Lifelong Learning, defines competences as a combination of knowledge, skills and attitudes: in other words, they are composed of concepts and facts (i.e. knowledge), descriptions of skills (i.e. the ability to carry out processes) and attitudes (i.e. a disposition, a mindset to act).

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Based on the above definition, the Digital Competence Framework for Citizens, also known as DigComp, provides a common language to identify and describe the key areas of digital competence. Over the last decade, DigComp has become a tool to improve citizens' digital competence, plan education and training initiatives to improve the digital competence of specific target groups, and help policy-makers formulate policies that support digital competence building.

In this paper, the DigComp 2.2 update is first discussed and then some examples of uptake are given where DigComp is used to support curriculum planning, instruction, assessment and certification processes as well as policy-making and policy monitoring. It is argued that all these components are integral parts of education ecosystems and can help digital transformation of European education.

2 Background

The first DigComp reference framework was published in 2013 defining digital competence as a combination of 21 competences grouped in five main areas [2]. DigComp was revised first in 2016 defining its five areas as Information and data literacy; Communication and collaboration; Digital content creation; Safety; and Problem solving [3], and then in 2017, the 8 proficiency levels were established [4].

The DigComp framework is composed of five dimensions that outline the underlying data model (Table 1). Dimensions organise various elements of the framework and show how they relate to one another.

Table 1. The DigComp data model.

Main dimensions of DigComp	
Dimension 1.	**Areas** identified to be part of the digital competence
Dimension 2.	**Competence descriptors and titles** that are pertinent to each area
Dimension 3.	**Levels of proficiency** for each competence
Dimension 4.	**Examples of the knowledge, skills and attitudes** applicable to each competence
Dimension 5.	**Use cases** on the applicability of the competence to different contexts.

Dimension 1 and 2 form the *conceptual reference model* comprising the competence areas, titles and their descriptors. Dimension 3 describes the eight proficiency levels, whereas Dimension 4 and 5 describe various examples related to each competence. The two latter ones add value and context to the conceptual reference model and thus, they are not intended to be exhaustive. Dimension 4 focuses on examples of knowledge, skills and attitudes (the 2.2 update), and use cases pertaining in specific contexts (e.g. learning and employment) are described in Dimension 5.

3 The Digital Competence Framework for Citizens 2.2

3.1 Aim of the Update

In March 2022, an updated version of the Digital Competence Framework for Citizens was published which consists of more than 250 new examples of knowledge, skills and attitudes [5]. These address key themes that are relevant in today's society such as.

- misinformation and disinformation in social media and news sites (e.g. fact-checking information and its sources, fake news, deep fakes) linked with information and media literacy;
- the trend of datafication of internet services and apps (e.g. focus on how personal data is exploited) and emerging technologies such as Internet of Things (IoT);
- citizens interacting with AI systems (including data-related skills, data protection and privacy, but also ethical considerations);
- environmental sustainability concerns (e.g. resources consumed by ICT); and
- new and emerging contexts (e.g. remote work and hybrid work).

The update was conducted as an open collaborative co-creation process where practitioners (e.g. those already using DigComp in education and training) and academics were invited to join the process in December 2020. Over hundred individuals participated in the process which was led by the Joint Research Centre of the European Commission. The process is explained in detail in [5].

3.2 Formulation of Knowledge, Skills and Attitudes Examples

In DigComp 2.2, for each of the 21 competences, 10–15 statements were formed to illustrate timely and contemporary themes that stem from recent developments and current practices in the digital world. To illustrate such developments, a scenario of citizens interacting with systems driven by Artificial Intelligence (AI) is elaborated in the text below with links to a small number of new examples in Table 2.

Table 2. Examples of knowledge, skills and attitudes pertinent to a given competence (source: DigComp 2.2[5]).

Competence	Example	Type
2.6 Managing digital identity	**Aware that** AI systems collect and process multiple types of user data (e.g. personal data, behavioural data and contextual data) to create user profiles which are then used, for example, to predict what the user might want to see or do next (e.g. offer advertisements, recommendations, services)	Know-ledge
2.6 Managing digital identity	**Knows how to** modify user configurations (e.g. in apps, software, digital platforms) to enable, prevent or moderate the AI system tracking, collecting or analysing data (e.g. not allowing the mobile phone to track the user's location)	Skill
4.2 Protecting personal data and privacy	**Weighs the benefits and risks** before allowing third parties to process personal data (e.g. recognises that a voice assistant on a smartphone, that is used to give commands to a robot vacuum cleaner, could give third parties - companies, governments, cybercriminals - access to the data)	Attitude

Scenario: Many everyday technologies integrate some type of artificial intelligence, e.g. to translate voice commands into a concrete action such as making a call, turning the lights on or starting up a robot vacuum cleaner. However, a few people are aware that such systems can collect personal data about the user, their context (e.g. location where the vacuum robot cleans) and actions (e.g. time of the day). Even more seldom users seem to realise that such data can be used for a multitude of purposes (e.g. not only training AI algorithms, but data can also be shared with third parties for various purposes). This brings a range of privacy or safety concerns.

In Table 2, the left column names a *competence* (e.g. 2.6 Managing digital identity), then in the middle column an *example statement* is given and the right column shows the *type* of statement (knowledge, skill, attitude) following a certain wording (see terms in **bold**). All examples in Table 2 are related to the above scenarios with the aim to help citizens become more confident, critical, and yet open-minded users of today's technologies, while helping mitigate risks related to safety, personal data and privacy.

4 DigComp as Part of Education Ecosystems

4.1 Instructional Planning

The new examples are intended to help curriculum planning and updating existing syllabus in education and training. Especially across schools in Europe (ISCED levels 1, 2, 3), nearly half of the European education systems refer to the European key competence definitions for digital competence and DigComp areas are addressed in terms of learning outcomes [6]. Therefore, the new examples can become helpful as a basis to update descriptions of learning objectives to better illustrate the application and integration of emerging technologies in curriculum.

A number of other training providers and public sector actors also use the DigComp framework to guide their training programs and course syllabus (for further information see [7]): the 2.2 update will also support them refreshing training content and creating more relevant learning experiences.

4.2 (Self-)Assessment

Digital competence assessment is one of the key components of education ecosystems and in this area too, the DigComp framework has contributed to supporting different actors and tools. The French implementation of PIX [8] is one such example of task-based digital competence testing grounded on DigComp. It can be used to assess, develop, and certify individual's digital skills – even at global level.

On the other hand, self-assessment of digital competence can also offer a promising proxy to a more objective testing. DigCompSat is a self-reflection tool to assess all 21 DigComp competences corresponding to proficiency levels 1 to 6 [9]. The item bank is composed of 82 self-assessment questions that have sound psychometric properties including their validity and internal consistency. DigCompSat, which is available under open license, perform three main functions: it measures existing competences at area level based on the respondents' self-assessment; identifies competence gaps; and raises awareness of what digital competence means. The self-assessment can be taken online at mydigiskills.eu. Similar self-assessment tools are provided in all EU languages by the European Commission on the Digital Skills and Jobs Platform[10] and as part of the Europass CV Online tool [11].

4.3 Certification

At national as well at EU level, certification is one of the key components of an education ecosystem. For example in Austria, it is possible to obtain certificates to prove digital competence in a certification system according to the Austrian version of Digital Competence Framework (DigComp 2.2 AT), the development was supported by the Federal Ministry for Digital and Economic Affairs, and the association fit4internet [12].

Currently, the European Commission is exploring the development of a European Digital Skills Certificate, based on DigComp, to support the recognition of digital skills of individuals by employers, training providers, and others, in a consistent manner. A feasibility study is set up to explore different scenarios for such certificate, the study

will also map existing digital skills certification schemes in Europe and carry out a gap analysis to understand the added value.

4.4 Policy Target Setting

Since 2015, the European Commission has monitored the level of EU citizens' digital activities using the Digital Skills Indicator (DSI) [13]. Initially this composite indicator was based on DigComp's four competence areas (information, communication, content creation and problem solving), and since 2022, the fifth area of Safety was added [14].

DigComp and the DSI also play a central role in guiding and monitoring efforts to achieve the ambitious EU objectives with regard to the digital upskilling of the whole population. In the Digital Compass for Europe's digital decade, the EU has set the policy targets of reaching a minimum of 80% of the population with at least basic digital skills by 2030 [15].

5 Further Discussion

A vibrant digital ecosystem for education and training in Europe needs collaboration and cross-pollination across national and regional education systems in order to take advantage of European cultural richness and its diversity. Open reference frameworks can facilitate this in terms of offering an open and transparent way to identify common interests and areas for collaboration and co-construction, and to further learn from each other's practices. As illustrated above, DigComp has been used in various areas of education ecosystem (e.g. curriculum planning, assessment, certification, policy-support) by offering a reference framework that can support digital transformation and further help shaping education ecosystems within Europe - and eventually also across its education systems. DigComp's strength is its flexibility and how it can be adapted to local needs while still keeping a reference at European level through providing a common understanding of what digital competence is.

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Inclusive Education

Training Disadvantaged People with the Support of Digital Measuring Tools

Gábor Papp(✉), Péter Áron Horváth, and Róbert Sinka

PractiWork Zrt, Budapest, Hungary
papp.gabor@practi.hu

Abstract. The most important role of education is to promote successful employment by equipping students with the abilities, skills and knowledge they need. In our study, we present the results of a programme to assess disadvantaged workers using digital measurement tools and to develop a training programme based on the results. The results of the programme were compared with a reference group of currently unemployed people who were already working. Based on this, we conducted a training and then assessed the participants again after one year. The skills developed by participants were significantly closer to those of people already in work, which increases the success rate of job search.

Keywords: Assessment · Cognitive ability · Disadvantaged · Training

1 Introduction

According to UNESCO, education is the process of facilitating learning or the acquisition of knowledge, skills, values, beliefs and habits (UNESCO SDG, 2022). The main goal of education is to ensure that students have all that is necessary to become a successful, self-reliant, productive and virtuous member of society. But what is absolutely necessary? Success in the labor market depends on a number of conditions. Some of these are conditions over which the individual has very little control. For example, the global economic situation, or the global health situation (see the current pandemic) are all factors that determine job placement. These are factors over which not only the individual, but also the education system has only a negligible influence, and are therefore not the focus of this study. We focus our attention on the individual's own inner qualities and most important characteristics.

As UNESCO stated, education should be responsible for the acquisition of necessary abilities, skills and knowledge to become efficient in the labor market. However, the quality of education in a country is not at all the same in different regions, educational disadvantage is present almost everywhere. It usually includes inequalities in educational outcomes, which can seriously hinder the successful employment. Is it possible for people who live in a disadvantaged area to possess all the abilities and skills that is required? This is a hard question to answer, because it is not easy to determine exactly what should a worker have and what has a person living in a disadvantaged region? A theory-based methodology and measurement tool is needed to answer this question.

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In this paper we look at this issue from a labor market perspective. We first define what might be needed in the labor market, presenting a theoretical framework, then we discuss the effectiveness of a training programme supported by a digital measurement system in a disadvantaged Hungarian region. The programme lasted for approximately two years and was designed to reintegrate disadvantaged people who, for various reasons, had not received an adequate education or had dropped out of the education system, back into the world of work.

1.1 What is Needed at the Workplace?

Currently there are almost countless occupations, and according to The Occupational Information Network (O*NET), which was developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA) "every occupation requires a different mix of knowledge, skills, and abilities, and is performed using a variety of activities and tasks". But do they have anything in common?

According to researchers and HR professionals, cognitive ability is one of the most important factors in predicting job performance (Grobelny 2018). However, there is an ongoing debate in the literature about whether general or specific cognitive abilities predict job performance better. Human resource management researchers generally view cognitive ability as a one-dimensional construct. This is because many believe that general cognitive ability has relevance for selection (Schmidt and Hunter 1998, 2004) and that measuring specific cognitive ability in a narrower domain is not worth the time and effort (e.g. Hunter 1986). These claims are largely supported by meta-analyses based on studies of the validity of general ability tests and incremental validity analyses using hierarchical regression models (e.g., Carretta and Ree 1997; Schmidt and Hunter 1998). The use of a one-dimensional approach in the human resources field is convenient from a practical point of view, as it offers a simple and parsimonious solution that does provide a not too bad estimate (Schneider and Newman 2015).

The mainstream approach emphasizing the predictive role of general cognitive ability is based on three main arguments: 1) general cognitive ability is the single most valid predictor of job performance, 2) the predictive validity of general cognitive ability is independent of the occupational context, and 3) specific cognitive ability is not expected to have incremental validity (Schmidt 2002). However, there are doubts about all three claims. The evidence supporting the higher predictive validity of general cognitive ability comes mainly from meta-analysis-based studies. These types of studies summarize the results of the validity of different tests from hundreds of samples, usually highlighting a single main coefficient and pooling the results of several studies conducted under different conditions in different contexts. As a result, a large amount of contextual information is lost due to generalization.

In addition, there have been several conflicting results that have not shown any predictive power of general cognitive ability on job performance, e.g., in law enforcement occupations (Hirsh et al. 1986), salespeople (Hogan et al. 1992; Verbeke et al. 2008), bankers (Barros et al. 2014), and insurance brokers (Downey et al. 2011). However, some specific cognitive abilities have been shown to be reliable predictors (with higher validity than general cognitive ability) in some contexts, e.g., mechanical understanding and reasoning in manufacturing workers (Muchinsky 1993), performance speed in office workers (Whetzel et al. 2011), and perceptual speed in warehouse workers (Mount et al. 2008). According to Krumm et al. (2014), recent meta-analysis-based studies suggest that specific cognitive abilities can not only complement but also surpass the predictive power of general cognitive ability.

There are a number of factors that may moderate the predictive power of both general and specific cognitive abilities on job performance. On the one hand, if specific cognitive ability scores are calculated according to specified criteria, estimated specifically for the occupational group under study, they are responsible for a significant part of the variance in job performance. (e.g. Schneider and Newman 2015). General cognitive ability, on the other hand, loses its predictive power for job performance when other attributes, such as social skills, are also taken into account (e.g. Schneider and Newman 2015). Third, for performance measures that are more reliable than supervisor ratings, general cognitive ability has been found to be only a weak or non-significant predictor (e.g., La Grange and Roodt, 2007).

According to Schneider and Newmann's (2015) compatibility principle on the relationship between cognitive abilities and job performance, general cognitive abilities predict general job performance, while specific cognitive abilities predict specific job performance. This principle is based on both the theoretical work of Ajzen and Fishbein (1977, 1980) on attitude-behavior compatibility and empirical research on the predictive validity of specific cognitive abilities (e.g., Reeve 2004; Hunter 1986; Joseph and Newman 2010). Grobelny made a similar assumption based on (Motowidlo 1997), Borman and Schmidt's (1997) theory of individual differences in job performance. According to this theory, variance in job performance is caused by variation in characteristic adaptations. Characteristic adaptations are the result of specific skills and patterns in workers' behaviors, individual differences in personality and abilities, and interactions with learning experiences from the environment. They represent the implementation of specific behaviors that are necessary to perform a particular job, and the implementation of specific behaviors can be linked to specific narrow domain skills (Sternberg 2001). Within particular occupations, similar tasks and behaviors are generally required to be performed, and thus a defining specific cognitive ability can be assumed to underlie them. In contrast, general cognitive ability plays a role in general problem solving and functioning, which may play a role in predicting performance, but not to the same extent as specific abilities. Since different occupations differ significantly in the actions they require, they also differ in the specific adaptations they require. These suggest that the predictive validity of specific abilities also varies widely across occupations. Grobelny's (2018) own research backed up his ideas. Specific cognitive abilities had higher predictive power than general cognitive ability, and the predictive power of different abilities depended on the job in question.

Based on these theoretical and empirical studies we conclude that it is more useful to test specific cognitive abilities in a job performance assessment because they are more predictive of job performance. We assume that this also means that specific cognitive abilities should play a more prominent role in school education, because they lead to a potentially more successful employment. Because of this, their study is therefore warranted. However, in order to know what needs to be examined, a theoretically sound taxonomy is necessary. The Cattel-Horn-Carroll model of intelligence is one of the most obvious options, as it is currently considered the most widely accepted model and the one best supported by empirical research (Sternberg 2012). The Cattel-Horn-Carroll model claims that there is a large number of various cognitive abilities, and they can be grouped into 3 strata: stratum I, "narrow" abilities; stratum II, "broad abilities"; and stratum III, consisting of a single "general ability" (or g). Below the *g* there are eight broad abilities: Comprehension-Knowledge (Gc), Fluid reasoning (Gf), Quantitative knowledge (Gq), Reading & Writing Ability (Grw), Short-Term Memory (Gsm), Long-Term Storage and Retrieval (Glr), Visual Processing (Gv), Auditory Processing (Ga),Processing Speed (Gs). A number of extensions to CHC theory was also proposed, including Domain-specific knowledge (Gkn), Psychomotor ability (Gp)and Psychomotor speed (Gps). A full review about the model can be found in Schneider and McGrew's (2012) study.

1.2 Education in Disadvantaged Regions

Presenting all the issues with the education in underdeveloped regions is beyond the scope of this paper, however, we would like to note a few important points. Most countries have areas that are underdeveloped compared to other regions of the country. Such regions are characterized by poverty, less developed educational infrastructure and few job opportunities. There are several aspects of educational disadvantages: high teacher turnover, low retention rates, less confidence in the benefits of education, limited cultural facilities in the community, lack of employment opportunities for school completers, and a less relevant curriculum (Lamb et al. 2014). Students in underdeveloped areas perform worse than students in developed areas, student reading literacy and school learning environments are less positive (Sullivan et al. 2018).

Digital education is difficult to implement in these regions, where families often do not have access to the internet or digital tools. Digital illiteracy is in itself a disadvantage in the labor market, where digital technologies are becoming more prevalent, and the lack of access to smart tools can create a negative attitude towards digitalization. Considering the trend that in many places digital assessment procedures are used in the selection of employees, it is also possible that the lack of digital skills and tools may lead to underperformance in tests that are digital.

This is why we need to be very careful when using digital tools to teach them and assess their performance. In every assessment it is important that the procedure is sufficiently standardized to minimize potential differences, and this is particularly important for people living in underdeveloped regions. We need a procedure that is easy for them to use, standardized and that gives them the opportunity to demonstrate their real abilities.

2 Training Programme for Disadvantaged People

2.1 Training Participants

The goal of the training was to reintegrate disadvantaged people into the labor market. The European Code of Conduct for Research Integrity and the Ethical Principles of the Hungarian Psychological Society have been fully taken into account in the development of the programme. 120 people participated in the programme. The average age was 35 years and the sex ratio was approximately equal. Participants volunteered for the programme and could count on the help of an inclusion mentor throughout.

2.2 The Programme Process

The programme started with a pilot study in 2018 to identify the requirements for those jobs in the region that can be filled without higher education. These are the jobs in which participants have the best chance of finding a job. As part of the pilot study, we carried out a skills assessment with a digital system in two large companies in the region, mainly looking for people to work on the production line. The results of this assessment served as reference (N = 120), to which we could compare the results of the training participants.

After the pilot study, we carried out the assessment (which began in 2019) of the participants, using the same digital tools as in the pilot study. The assessment took place in 6 different settlements, in groups of 20 people. The purpose of this was to take stock of the situation and to help identify further training directions. The initial measurement was followed by a 30-h training which aimed to develop those areas that required development. The choice of areas to be developed was subject to certain constraints. The aim was not to develop knowledge, and this training is not the most appropriate for this purpose. It was also not intended to bring about changes in personality traits, as such a result could not be expected from a 30-h training course. The focus was on abilities and skills that could be changed in a meaningful way. During the training, participants were given tasks that tested their logical thinking or manual dexterity. The tasks were followed by discussion and then by the implementation of new tasks, so that the participants could actively incorporate what had been discussed into the new tasks.

Another assessment followed the 30-h training session. This assessment measured those characteristics that we aimed to develop. Again, it took place in the same settlements as the initial assessment. Then, for a year, the participants received constant support from a mentor. The mentor's job was to provide counselling or any assistance regarding writing CV-s, helping in job searching or preparing for interviews. They did not provide further skill training. A year after the training, a further assessment was carried out to see if any long-term progress could be identified.

In this study, we focus on the results of the assessment and the changes in the specific abilities, the presentation of the whole process is beyond the scope of this paper.

2.3 Method

To measure cognitive abilities, a digitalized test system (*PractiWork®,* https://practiwork.hu/ 2022) was used. The test system was developed in accordance with strict psychometrical procedures, and it was designed to measure abilities, skills and personality traits. The ability tests were developed on the basis of the CHC theory and therefore each test was designed to measure a chosen narrow ability. Restrictions had to be made on the range of characteristics assessed. As the participants in the programme were volunteers, a measurement protocol had to be designed that would result in them wanting to remain in the programme. For this reason, a balance had to be struck between the amount of characteristics to be assessed and the test time available for completion, so that a sufficiently wide and relevant range of job-relevant characteristics could be assessed, but without the test time being prohibitively long. The completion of the test took about 2.5–3 h.

Based on the research provided by Grobelny (2018) and labor market experience, the system was designed to measure the following abilities:

- *Quantitative reasoning*. The ability to perform basic mathematical operations.
- *Deductive reasoning*: The ability to understand presented rules and patterns, and to use them to solve tasks.
- *Short-term memory:* The ability to apprehend and hold information in immediate awareness and then use it within a few seconds.
- *Perceptual accuracy:* The ability to accurately perceive presented stimuli, and select those that complies with the rule.
- *Speed of reaction:* The ability to provide a quick reaction to a presented stimulus.
- *Visual debugging:* The ability to accurately perceive presented stimuli, and select those that does not comply with the rule.
- *Dexterity:* The ability to work precisely with small objects using fine motor skills.
- *Eye-hand coordination:* The ability to coordinate eye and hand movements
- *Hand stability:* Ability to move the hand and arm in a stable manner

The system uses T-score, a value that is common in psychometrics. T scores in psychometric testing are positive, with a mean of 50, and a standard deviation of 10. T scores represents the number of standard deviations from the mean, most people prefer it because the lack of negative numbers, which means they are easier to work with and there is a larger range so decimals are almost eliminated.

2.4 Results

In this section we present the results of the assessment of the participants. The following Table 1 summarizes the results of the initial assessment.

Table 1. Comparison of the results of reference group and the participants after the initial assessment

	Reference group		Participants	
	Mean	SD	Mean	SD
Quantitative reasoning	51.15	8.56	48.20	10.63
Deductive reasoning	50.71	9.80	45.93	12.73
Short-term memory	53.45	8.99	46.87	9.10
Speed of reaction	52.18	7.78	47.35	11.39
Perceptual accuracy	53.73	6.76	40.93	18.36
Visual debugging	49.45	13.48	49.38	7.35
Dexterity	53.46	6.80	48.98	9.14
Eye-hand coordination	51.25	9.17	44.30	17.23
Hand stability	51.93	7.88	49.33	10.64

We found significant differences between the two groups in quantitative reasoning ($t\,(238) = 2.367, p = 0.01$), deductive reasoning ($t\,(238) = 3.259, p < 0.01$), short-term memory ($t\,(238) = 5.634, p < 0.01$), speed or reaction ($t\,(238) = 3.836, p < 0.01$), perceptual accuracy ($t\,(238) = 7.167, p < 0.01$), dexterity ($t\,(238) = 4.308, p < 0.01$), eye-hand coordination ($t\,(238) = 3.900, p < 0.01$) and hand stability ($t\,(238) = 2.151$, $p < 0.01$).

The results show that there is a gap in attention skills and motor skills. Therefore, based on the results, we saw it as the most important to design a training programme that targets these areas. The 30-h training, which took place over 5 consecutive days, put the participants in task situations in which they had to use their motor skills, with the aim of working attentively and effectively. The training tasks included, for example, paper folding, but also the use of different hand tools. After the training, another, shorter assessment was conducted. Table 2 shows the results.

Table 2. Changes in the measured abilities after the training

	Before trainig		After training	
	Mean	SD	Mean	SD
Quantitative reasoning	48.20	10.63	-	-
Deductive reasoning	45.93	12.73	52.05	6.25
Short-term memory	46.87	9.10	-	-
Speed of reaction	47.35	11.39	-	-
Perceptual accuracy	40.93	18.36	-	-
Visual debugging	49.38	7.35	53.70	4.32
Dexterity	48.98	9.14	54.62	10.31
Eye-hand coordination	44.30	17.23	49.07	11.00
Hand stability	49.33	10.64	54.41	6.45

We found significant improvement in every measured ability (deductive reasoning: t (238) = 3.259, $p < 0.01$; visual debugging: t (238) = 5.550, $p < 0.01$; dexterity: t (238) = 4.484, $p = 0.01$; eye-hand coordination: t (238) = 2.556, $p = 0.01$ and hand stability: t (238) = 4.472, $p = 0.01$). More importantly, the differences we discovered between the reference group and the participants minimized, we could not find statistically significant differences between them in the trained abilities.

Finally, we present the results of the ability assessment that was conducted one year after the initial assessments. The aim of this final assessment was to discover if there are long-term improvements in the trained abilities. Table 3 presents the results.

Table 3. Results of the final assessment one year after the beginning of the programme

	Before trainig		After training		After one year	
	Mean	SD	Mean	SD	Mean	SD
Quantitative reasoning	48.20	10.63	-	-	47.6	9.02
Deductive reasoning	45.93	12.73	52.05	6.25	47.20	11.84
Short-term memory	46.87	9.10	-	-	50.08	8.79
Speed of reaction	47.35	11.39	-	-	49.19	10.74
Perceptual accuracy	40.93	18.36	-	-	49.64	10.20
Visual debugging	49.38	7.35	53.70	4.32	52.70	5.16
Dexterity	48.98	9.14	54.62	10.31	53.70	9.72
Eye-hand coordination	44.30	17.23	49.07	11.00	50.14	11.79
Hand stability	49.33	10.64	54.41	6.45	52.40	8.16

The results show that a slight decline can be observed in the examined abilities between the after training results and the after one year results. However, the most important result is that the initial differences between the reference group and the participants reduced, and in the case of fine motoric skills, they disappeared (dexterity: t (238) = 0.221, $p = 0.824$; eye-hand coordination: t (238) = 0.814, $p = 0.41$ and hand stability: t (238) = 0.65, $p = 0.045$)). Table 4 shows these results.

Table 4. Comparison of the reference group and the participants one year after the training

	Reference group		Participants	
	Mean	SD	Mean	SD
Quantitative reasoning	51.15	8.56	47.6	9.02
Deductive reasoning	50.71	9.80	47.20	11.84
Short-term memory	53.45	8.99	50.08	8.79
Speed of reaction	52.18	7.78	49.19	10.74
Perceptual accuracy	53.73	6.76	49.64	10.20
Visual debugging	49.45	13.48	52.70	5.16
Dexterity	53.46	6.80	53.70	9.72
Eye-hand coordination	51.25	9.17	50.14	11.79
Hand stability	51.93	7.88	52.40	8.16

3 Discussion

Educating people in disadvantaged regions is a major challenge. People living in disadvantaged areas are trying to enter the labor market from a much more disadvantaged position and face a significant digital technology gap. As the results showed, they underperform compared to those who have been already working. It is important to note that this does not mean that their cognitive skills are not sufficient to enable them to enter the labor market. It is possible that people who are not working currently don't use their skills that are necessary for the labor market, but when it is required, their inactive skills activate, and they can perform well. However, it seems that without help they will perform less well in a selection process, which in turn will hurt their chances in the labour market.

In order to successfully help these people in their post-school education and to orient them towards the right career path, there needs to be a measurement tool, preferably digitally based, with an appropriate theoretical background, to accurately track the level of the individuals being tested.

Our study presented one such practice, where a skills assessment was used to identify areas for improvement (compared to the level of skills on the labor market), to identify training needs and to monitor the level of progress. However, there are some limitations of this work. First, there were serious constraints about what to include in the measurement. The system we used was capable of measuring more cognitive abilities than we actually measured, and if they had been measured, it would have provided further significant information. Second, it would have been interesting to see whether the reference group has changed over a year. Unfortunately, it was not possible to repeat the measurement among them. The lack of a thorough follow-up is also a limitation of our study, however, the pandemic prevented us from carrying out the planned follow-ups.

Summarizing the results, it can be seen that the training has been effective. The manual skills of the participants improved, and, in general, the profile of the trainees

matches that of the workers who have been employed for a longer period of time and who form the reference group. These results show that it is quite possible, with the combination of measurement and training based on the results, to improve the abilities of disadvantaged people, thus improving their chances of finding work.

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Building an Inclusive Academic Environment: Challenges and Needs of Non-traditional Students and Potentials to Address Them

Marina Brunner(✉) and Ulf-Daniel Ehlers

Baden-Württemberg Cooperative State University, Karlsruhe, Germany
marina.brunner@dhbw-karlsruhe.de

Abstract. Higher Education Institutions in Europe are experiencing a steady growth of an increasingly diverse student body and are attracting a large number of new student groups, the so-called non-traditional students (NTS). Especially the Professional Higher Education (PHE) Institutions, with their rather strong combination of academic and work-based learning have special study conditions that can come with challenges for NTS. In order to embrace this increasing diversity, higher education institutions need to adapt structurally and culturally to the needs of these students and to enable inclusion in all parts of the institutional experience. One way of doing this is in partnership with the existing student quality assurance and representation structures within the universities, the student organisations. But even here, non-traditional students are not sufficiently represented to put their needs on the agenda. Our research has identified barriers and needs of non-traditional students and potentials to address them.

Keywords: Inclusivity · Professional Higher Education · Student engagement · Non-traditional students

1 Introduction

Higher Education Institutions (HEIs) are becoming more diverse with a new and more heterogeneous student body in terms of previous education, social and family background, gender, age, life-situation, motivation to study, current and future occupational profiles (Ehlers 2020). This is related to an ongoing process of expanding higher education, of opening access and of new labour market requirements asking for highly qualified graduates (Schuetze and Slowey 2002), asking for new strategies in order to do justice to the different facets of cultural and social background, the individual educational and experiential background and the living circumstances of the students (Nibuhr and Diehn 2012).

This also holds true for Professional Higher Education Institutions (PHEIs) because of the structure of PHEI, the target groups which they attract are different from purely academic universities. PHE curricula have specific characteristics that influence student engagement which is often overlooked in European and national higher education policy

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discussions, such as shorter times spent in the institution due to many students studying at shorter courses and considerable time spent on practical placements outside the institution (Camilleri et al. 2014).

For a Professional Higher Education Institution to be truly inclusive, it needs to reflect its diverse range of students. To achieve this, a PHEI should not just consider its study programmes and teaching and learning processes, but also aim for fully inclusive student engagement. Student engagement not only relates to student activism and student involvement in decision-making bodies, but also to the structures and practices of students' organisations themselves. All of these elements of student engagement do not fully reflect the diverse student community in a PHEI and can be difficult to access for non-traditional students and underrepresented student groups.

Therefore, non-traditional students (NTS) must be able to participate in student organisations in order to include them holistically in their university education and ensure that their voices are heard. This is the goal of the international InclusiPHE initiative[1]. To achieve this objective, the barriers and challenges regarding student engagement of non-traditional students need to be identified and adequate measurements should be defined to address them. In this context, this paper addresses two questions:

(i) What challenges and needs do non-traditional students have with regard to their involvement in student organisations?
(ii) What are the potentials to support the inclusion of non-traditional students?

2 Non-traditional Students and Student Engagement

The term non-traditional student is broadly used in the context of higher education (Brändle and Ordemann 2021). Hall (1997) provides a definition of diversity which can be applied to non-traditional students where he includes differences in age, ethnicity, gender, skin colour, national origin, physical, mental and emotional ability, religion, language, race, sexual orientation and socio-economic status (Hall 1997). In addition to speaking of non-traditional students, some refer to this type of students as underrepresented groups (Zinkiewicz and Trapp 2004). The definition of a non-traditional student is therefore also context-dependent and can have different connotations depending on the country, institute or field of study. In addition, the boundaries between traditional and non-traditional students are blurred, so a student can be traditional in some aspects and non-traditional in others at the same time (Schuetze and Slowey 2002). The National Center for Education Statistics (NCES) categorize a student as non-traditional if he or she inherits one of the following seven characteristics: Delays enrolment in college,

[1] The research was conducted in the context of the Erasmus Plus research initiative InclusiPHE - Inclusive Engagement of Non-Traditional Students in Professional Higher Education (website: https://inclusiphe.eu/). InclusiPHE is an initiative funded by the European Union; partners and contributors are Mondragon University (Spain), European Association if Institutions in Higher Education (Belgium), Baden-Wuerttemberg Cooperative State University (Germany), Knowledge Innovation Center (Malta), UC Leuven (Belgium), Institute for the Development of Education (Croatia), The Malta College of Arts, Science & Technology (Malta), European Students' Union (Belgium).

attends part time, works full time (35 h or more per week) while enrolled, financial independence, caretaking responsibilities, single parent, no high school diploma (Choy 2002). The problem with the imprecise definitions of non-traditional students is that if they cannot be identified, it is difficult to address their individual challenges and needs.

The 'Principles and Guidelines to Strengthen the Social Dimensions of Higher Education in the EHEA' report refers to a broad classification of student groups which can be applied to better understand the concept of non-traditional students. The first group mentioned are the **underrepresented students**. They are described as "underrepresented in relation to certain characteristics (e.g. gender, age, nationality, geographic origin, socio-economic background, ethnic minorities) if its share among the students is lower than the share of a comparable group in the total population" (EHEA 2020). Students often have combinations of several of these characteristics and the classification as underrepresented can also depend on the context and levels of higher education. The second group are the **disadvantaged students**, facing "specific challenges compared to their peers in higher education. This can take many forms (e.g. Impairment, low family income, little or no family support, orphan, many school moves, mental health, pregnancy, having less time to study because one has to earn one's living by working or having caring duties)" (EHEA 2020). The temporal dimension must be considered as disadvantages can be partly permanent and partly appear and disappear. A disadvantaged student can, but does not necessarily have to be an underrepresented student as well. The last group are the **vulnerable students**. As well as the disadvantaged students, they face specific challenges but have in addition a specific need for protection. This is the case for students with a risk for discrimination, who suffer from an illness or Impairment or whose residence permit depends on the success of their studies. This group are not always able to ensure their own well-being and need additional support and are therefore categorized as vulnerable students (EHEA 2020).

In this research context, every student who does not feel like an integral part of the student and institutional community and/or who, due to their specific circumstances, does not have the opportunity to get involved in student engagement during their studies is a nontraditional student, even if only to a small extent.

Student Engagement can be described as a process of collaboration between the higher education institute and the students to shape decision-making, structures and cultures in higher education. It is also often expressed in phrases like 'student voice' and 'students as partners' (Finn and Zimmer 2012). Healey, Flint and Harrington (2014) state that "[a]ll partnership is student engagement, but not all student engagement is partnership" (Healey et al. 2014). This suggests that when talking about student engagement and the development and optimisation of processes and structures, students should already be engaged in this process.

The National Student Engagement Programme (2020) defines four domains of student engagement. In the **'Governance and Management'** domain, student engagement is primarily understood as participation in committees in which they influence the development, implementation and evaluation of policies. The second domain is **'Teaching and Learning'** and refers to student engagement of students in their own learning and in the process of enhancing that learning experience. Third, **'Quality Assurance and**

Enhancement' means participation in all processes of quality assurance and enhancement. The last domain of student engagement is **'Student representation and organisation'**, giving students the opportunity to come together in self-organised groups, to participate in democratic processes, to elect representatives and to proactively start discussions about student-centred change within higher education institutions (National Student Engagement Programme 2020).

Student engagement can operate on various levels with different goals. It can be classified in seven levels. At the international level, the European Students' Union (ESU) is an example of an umbrella organisation of 45 National Unions of Students (NUS) from 40 countries, aiming to represent and promote the educational, social, economic and cultural interests of students at the European level towards all relevant bodies and, in particular, the European Union, Bologna Follow Up Group, Council of Europe and UNESCO. These unions or organisations can also be found on a national or regional level, often with a thematic, political or study programme-related agenda. On an institutional level, student-led organisations are given an active role in board discussions, policy making and general changes which affect all students at the institution. On Campus/Faculty level, student engagement includes students from the same campus or faculty who focus mostly on catering, facilities, mobility, etc. Student engagement on the Programme/Department level or the class level often takes place for students who enroll in the same programme, sometimes represented by class representatives, mostly focused on improving their learning experience and solving specific challenges in their programme together with their teaching staff. Student engagement on the individual level is about students engaging in their own learning process (Higher Education Authority 2016).

3 Research Methodology

The research initiative started in the end of 2020. In the first phase of the research process the research team set out for an iterative multiapproach research design in order to identify different characteristics of non-traditional students as well as barriers and needs related to their study experience and inclusive student engagement in Professional Higher Education.

In order to answer the research questions "What challenges and needs do non-traditional students have with regard to their involvement in student organisations?" the research team decided to employ a qualitative research methodology by focusing on expert opinions in written from February till March 2021.The experts drew their answers from internal studies, their own assessments and conversations with student support staff. In addition to the information derived from the qualitative expert surveys, four focus groups on national level with a length of two hours each, were conducted by the PHEIs in Malta, Spain, Belgium and Germany. As part of the research process, the opinions of 28 experts including student representatives and non-traditional students were collected and analyzed. To participate in the focus group, the individuals had to either belong to the group of non-traditional students, be a representative of a student-led organisation or have a professional background as a student-support staff or PHE institutional leader. The qualitative research contained questions to the following topics:

- Dimensions and characteristics of non-traditional students at PHEI.
- Student engagement opportunities at the individual institutes.
- Participation barriers for non-traditional students with a focus on extracurricular activities and student associations.
- Good practices at own institution or from broader society

Drawing from the European Students' Union/ESU's network, an international focus group was set up with representatives from four national student unions. Beforehand and based on the results of the internal research and the internal focus groups, a digital written survey was conducted, addressing specific research gaps from the previous research steps, complemented by the International Focus Group. The international focus group was recorded for internal documentation and the results were documented in forms prepared by the research team.

Due to the subsequent structure of the research process, the research steps could always be built upon the results and information gathered in the former research step, thus qualitatively building a set of contextualized data on inclusive student engagement of non-traditional students in PHEIs. The subsequent steps had been based on the previous ones in order to (1) validate research results from these steps, (2) close research gaps identified in these steps and (3) gain a deeper understanding of issues and challenges identified in these steps.

4 Results of the Empirical Study

4.1 Challenges and Needs of Non-traditional Students Regarding the Involvement in Student Organisations

Overall, the challenges and barriers for inclusive student engagement can be clustered into five main categories, namely time challenges, visibility challenges, identification challenges, image challenges and accessibility challenges. While some of these categories are set on a more cultural level (image and identification), others can be described as more structural challenges (time, visibility, accessibility) and taking place on different levels such as course level, institutional level, national level. During the COVID-19 shutdown, there is evidence that inclusive student engagement has undergone severe changes on the structural level but less so on a cultural level.

Time and finance challenges are closely related and can be described in different dimensions: students might have to work in order to finance their studies and thus have less time available for student engagement activities. Moreover, they might be reluctant to commit to a long-term engagement due to other activities and interests, international mobility, internships etc. Finally, a significant study workload might make student engagement seem to collide with one's own study goals and objectives.

Visibility challenges can be described as a lack of visibility of results of student engagement and participation, meaning decisions and changes made thanks to student engagement and participation, proving that it can make a difference and have a positive impact on the student situation. Furthermore, the actual engagement and participation opportunities as well as activities offered by student-led organisations must be visible and accessible to students - participation might be more difficult and selective if they are not. In order to participate, students need to know the possibilities to do so and understand the mechanisms of student participation. Motivation for student engagement might result from a concrete case of dissatisfaction and the concrete will for change (Ditzel and Bergt 2013). For students with less concrete cases, it might be harder to see why they should participate in student-led organisations. For example, students might not know any success stories or results of student engagement and participation.

Identification challenges can also be described in different dimensions: it might be harder for students to identify with student-led organisations if they do not relate to one's own interests, identity, everyday life and challenges. Moreover, students might be intimidated when they feel they do not have the right skills for joining an organisation and face insecurities of being welcome. The way students are depicted and portrayed in course and PR materials on an institutional, course or organisational level might also lead to identification challenges if the material paints a stereotyped picture of the student body and does not reflect its diversity.

Closely related to identification challenges, student-led organisations might face image challenges making it less attractive for some students to join. Student-led organisations might have an image of a place where political games take place and where many things are about students' popularity - students might feel that they do not fit in or not have enough confidence to join. Specific roles and positions are attributed through a selection and election process which might seem intimidating for some less extrovert students. The image of some student-led organisations related to heavy drinking and partying might put participation in contrast with academic achievement. In the UK, the term 'lad culture' has been coined in relation to this challenge, placing it firmly in a gender inequality perspective.

Finally, accessibility challenges might make it harder for some students to engage and participate in different activities on different levels. This might be related to language barriers, e.g. for international students, students with hearing impairments, or mobility barriers, e.g. for students with limited mobility, who live in another place than they study, who have caretaking responsibilities or physical impairments etc.

Based on the barriers mentioned in the internal research and the focus groups, different needs could be derived that relate to the various barriers and challenges of non-traditional students in relation to student engagement. Furthermore, the focus groups were also specifically asked for potentials and solutions that could help to shape student engagement in a more inclusive way. Table 1 shows an overview of possible potentials mentioned within the focus group and which challenge areas they address, which institutional level they target and which stakeholders should take responsibility for them.

Table 1. Potentials for inclusive student engagement of NTS

Potential	Related challenge area	Level	Responsibility	Structural or cultural
Different participation opportunities	Identification time and finance accessibility	All levels	Institutions student-led organisations	Structural
Visibility of diversity	Identification	All levels	Institutions student-led organisations	Structural cultural
Support system	Time and finance	Institutional	Institutions	Structural cultural
Contact points between SO & NTS	Visibility identification	Institutional	Student-led organisations institutions	Structural
Network between different levels of student organisations	Identification	All levels	Student-led organisations	Structural
Inform and professionalize teachers for different student needs	Identification	Institutional	Institutions	Cultural
Guidelines and policies for and from non-traditional students	Image identification	All levels	Student-led organisations institutions	Cultural structural
Paying students/include student engagement in the curricula	Time and finance	Institutional	Institutions	Structural

5 Conclusion

The InclusiPHE initiative aims at making Professional Higher Education more inclusive and student engagement more open to all students. In a first step, a broad research has been conducted in order to better understand the characteristics of non-traditional students and the barriers and challenges they face in higher education. Some potentials and good practices have already been identified. In cooperation with experts two self-evaluation measurements, both for institutions and student organisations will be developed.

The research undertaken has included many stakeholder perspectives and also included the voices of (non-traditional) students themselves in semi-structured internal

research conducted and several focus groups and interviews. This has left the research team with a deeper understanding of the challenges and barriers NTS are facing in PHEIs, and measurements to address them.

The research undertaken has taken place during the COVID-19 shutdown. All research and coordination activities have taken place digitally, thus influencing the research process. The digital format of, for example, focus groups, could be a barrier for some students to participate and it might be harder to reach non-traditional students. On the other hand, the digital format might make it easier for other stakeholders, e.g. with heavy schedules, to join and hence make it possible to have many different persons participate in the focus groups and the research process. Concerning the participation of non-traditional students, it has been stated before that their voices should be crucial in the research process by having them participate in focus groups, with the related challenges of reaching them and knowing exactly who they are - this being a research gap itself. One approach has thus been not to invite representatives of all types of NTS (this holding the risk of tokenizing or stigmatizing students and of 'missing' some of them) but to create a diverse focus group participant setup in order to gain a broad range of perspectives on inclusive student engagement of non-traditional students. However, it can be assumed that not all the necessary perspectives have been reflected during the research process.

Getting to know our students and the challenges they are struggling with is crucial - and so are solutions for getting in touch with them, of getting to know them, of receiving feedback from them - and of making them engage. This also means to rethink ways of engaging – and of showing what engagement is and means.

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Correction to: Shaping the Digital Transformation of the Education Ecosystem in Europe

Terje Väljataga and Mart Laanpere

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Author Index