Web 2.0 Personal Learning Environments for Development University Teacher Competencies

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***Abstract*—Personal Learning Environments (PLEs) are effective tools for cultivating highly qualified and competent teachers. The current study aims to explore how a PLE Web 2.0 based on the e-me educational platform can be used to develop competencies of higher education teachers. The study participants were 120 teachers from six faculties of Ahmet Yesevi University (Turkistan, Kazakhstan). The main research tool used was the High-Quality Teacher Competencies Questionnaire (HQTCQ). The PLE-based training allowed teachers with 3–9 years of experience (Group A) and 10–20 years of experience (Group B) to improve several competencies, including personal qualities, pedagogical goal setting, student motivation, information competence, development of educational programs and materials, and organization of pedagogical activities. Group C participants with 20+ years of experience became more competent in motivating students and organizing teaching activities. Thus, the conducted training had the greatest impact on less experienced teachers. The research findings have practical implications, as they highlight the potential for improving teacher competencies through personal learning environments. The study findings also emphasize that educational institutions can implement similar PLE interventions to improve the competence of their teaching staff.**

***Keywords*—competencies, personal learning environments, educational platform, student motivation, pedagogical activities**

I. Introduction

In today's world, educators are not limited to traditional classrooms and textbooks. They have access to a variety of modern tools and resources, which allow them to effectively interact with the digitally savvy younger generation [1]. Web 2.0 technologies have ushered in a new era of personalized and interactive learning. As a result, teachers can expand their horizons and improve their teaching practices in the ever-evolving education field [2]. Teachers of the 21st century are faced with the challenge of preparing students for a world characterized by digitalization, globalization, and information abundance [3]. As the classroom evolves from a static environment to a dynamic, connected space, the demands on teachers are growing exponentially. Thus, to meet these demands, teachers must not only be experts in their field but also be digitally literate [4]. Unlike its predecessor, Web 2.0 represents user-generated content and is characterized by a high level of collaboration and interactivity [5].

The rise of Web 2.0 has resulted in the creation of numerous platforms, online communities, and tools that allow people to create and share content. This shift had profound implications for education, as it provided new opportunities for personalized learning, collaboration, and teacher-student interaction [6]. Personal Learning Environments (PLEs) are a reflection of the Web 2.0 paradigm in education. Web 2.0 describes dynamic, learner-centered ecosystems that allow individuals to take control of their learning [7]. PLEs include a wide range of tools, resources, and strategies that allow students to set learning goals, access relevant content, collaborate with peers, and reflect on their progress [8]. For teachers, PLEs offer a transformative approach to professional development throughout teaching practice [9, 10].

A highly qualified teacher needs traditional pedagogical knowledge. Modern teachers must possess a diverse set of competencies to meet the needs of the student community and face the challenges of the digital age [11, 12]. The Web 2.0-based PLEs provide teachers with platforms that help them develop high-quality competencies. Moreover, they provide access to a variety of learning resources, enable collaboration, customize the learning process, integrate digital tools, and improve pedagogical approaches [13]. By implementing Web 2.0-based PLEs in higher education, we can ensure that students have all the digital tools and resources they need to shape their own learning experiences [14]. The teachers, in turn, should encourage students to create individual learning paths, set goals, and choose resources that match their academic needs and interests [15]. Finally, universities should not only promote digital literacy and self-learning but also offer support to both students and teachers. This way, we can maximize the benefits of using PLEs in higher education [16, 17].

The novelty of the research findings lies in the exploration of Web 2.0 Personal Learning Environments (PLEs) as a transformative tool for fostering and enhancing the competencies of university teachers. This study delved into the unique capacity of PLEs to provide tailored, interactive, and adaptable learning spaces that empower educators to cultivate diverse skill sets, pedagogical approaches, and technological proficiency essential for contemporary teaching demands.

The current paper is a timely response to the constantly developing technology. It contributes to educational research by studying the impact of PLEs on teacher competencies. In addition, the paper informs functionaries about the measures necessary for the development of high-quality competencies. This approach allows educators to improve their skills, leverage career-long learning, collaborate with other teachers and students, personalize professional development, and

better adapt to the changing demands of the modern world. Overall, this paper provides information valuable for shaping the future of training university teachers.

II. Literature Review

The Web 2.0 personal learning environment is a learner-centered digital ecosystem used to create, manage, and exchange personalized learning experiences [18]. Unlike traditional Learning Management Systems (LMS), PLEs are decentralized. This factor allows students to manage and customize their learning by integrating various web-based tools, applications, and resources [19]. The concept of a PLE arose as a response to the changing landscape of the Internet and educational technology. Its appearance was driven by the idea that students should have more control over their learning and be active participators instead of passive consumers [20]. A PLE is not a single platform or software, but a personalized set of tools chosen by the learner [21]. Examples of such tools include blogs and wikis, social platforms, forums and communities, content tools, online learning platforms, etc. [22, 23]. In higher education, Web 2.0 PLEs can be used in many ways. For example, to search the Internet for relevant information and content on a certain topic or to collaborate on projects using online platforms that match students' preferences [24]. Also, both teachers and students can use PLEs for professional development. Specifically, they can follow blogs, take online courses, or become a part of communities related to their academic or career interests [25]. PLEs promote global interaction by allowing students to connect with peers, experts, and educational resources from around the world. Likewise, PLEs allow educators to effectively communicate with each other and their students, which can develop their digital competency [26]. Teachers can also use PLEs in flipped classrooms by assigning online content for students to watch before class and using class time for active discussions and knowledge application [27].

From a theoretical point of view, a teacher's professional competence can be considered as a set of knowledge, abilities, and skills developed as a result of teaching an academic subject. A teacher also can perform certain activities [28]. High-quality teacher competencies are skills and qualities that enhance the effectiveness of a teacher and allow them to meet the needs of students [29]. These competencies cover various aspects, including knowledge of the subject, teaching skills, and technology skills [30]. High-quality competencies may also include: 1) encouraging students to think critically, analyze information, and solve complex problems; 2) effective communication with students, parents, and colleagues; 3) teamwork skills; 4) willingness to adapt to changing educational environments and engage in ongoing professional development [31]. Competencies related to personal qualities and the organization of pedagogical activities are considered fundamental and are expected of all teachers. However, competencies related to pedagogical goals, student motivation, provision of information, and curriculum development are considered high-quality. They reflect advanced teaching skills and experience [32, 33]. High-quality competencies typically require deeper knowledge, experience, and mastery to be effectively applied in the classroom [34].

The topic of PLEs is closely related to the competencies of highly qualified teachers. Personal learning environments provide teachers with tools and strategies to develop and improve their competencies [14]. Such environments often include a variety of digital tools and resources. Hence, they encourage teachers to adopt a growth mindset, engage in lifelong learning, and adapt teaching methods to individual student needs [35]. Teachers must be able to implement PLEs in their classrooms, as it can help students develop digital literacy and acquire twenty-first-century skills [36]. However, integrating PLEs into higher education may entail certain challenges and barriers that may hinder its successful implementation [9]. Firstly, teachers may not be prepared for the transition and may lack the necessary digital skills or knowledge to safely use Web 2.0 and protect students' data [37]. Second, a lack of adequate training and support as well as unstructured implementation of PLEs can lead to fragmentation of learning resources across different platforms. Besides, the quality of online resources can vary widely [38]. By addressing these challenges and implementing supportive measures, higher education institutions can facilitate successful PLE integration. This will allow teachers to develop their competencies and improve student learning experience.

The current paper aims to explore how the use of Web 2.0 PLEs affects the development of high-quality competencies among higher education teachers. The study was conducted to determine how PLEs can actively promote the acquisition and improvement of these competencies. The article highlights the relevance of PLEs in the changing educational environment and serves as an information resource for teachers, higher education institutions, and functionaries. In addition, the article aims to stimulate further research in the field of educational technology and teacher training. By offering empirically grounded findings, the article aims to inspire educators and institutions to explore and implement best practices related to PLEs in professional development initiatives. The main objectives of the study are:

1) Establish the baseline competencies of teachers depending on their work experience.
2) Evaluate teacher competencies upon completion of the PLE-based training, compare the pre-test and post-test values, and draw relevant conclusions.
3) Determine which of the study groups experienced the most significant improvement by comparing the obtained results and establishing the reliability of the differences.

III. Methods and Materials

A tool for identifying high-quality teacher competencies was designed specifically for this study. Thus, the descriptions of competencies presented in a recent article [32, 39, 40] were used to develop the High-Quality Teacher Competencies Questionnaire (Appendix 1). The questionnaire has six competence subscales: (1) personal qualities, (2) pedagogical goal setting, (3) student motivation, (4) information competence, (5) development of educational programs and materials, and (6) organization of pedagogical activities. The questionnaire contained 60 statements that had to be rated on a 5-point Likert scale (1-strongly disagree; 5-strongly agree).

The questionnaire was validated and its reliability was systematically assessed. Initially, educational and research experts assessed the content validity of the questionnaire items to ensure that each item accurately reflected the intended competencies. The expert feedback and suggestions were taken into account to improve the clarity and relevance of the questionnaire. Subsequently, pilot testing of the questionnaire was conducted with a small sample of teachers (n = 40). It allowed for the identification of ambiguities, inconsistencies, or other problems. Based on pilot testing, minor changes were made to improve the wording and clarity of certain statements. The Cronbach's alpha was calculated for each block of competencies to assess the reliability of the questionnaire. The results showed high internal consistency for each block: Cronbach's alpha values ranged from 0.87 to 0.91, which demonstrated high reliability.

In addition, the e-me digital education platform, namely its European edition, was used in the current study. One of the recent studies also used the Greek edition as a personal learning environment [41]. The interface of this platform is shown in Fig. 1.

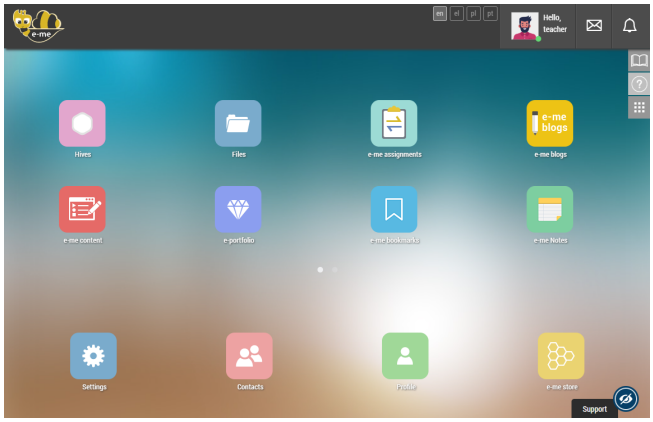

Fig. 1. The e-me digital education platform.

The e-me platform is a personal learning environment that provides learning through private and public collaboration spaces (Hives). The platform also promotes communication and social networking, offering cloud-based file storage and exchange [42]. In addition, e-me supports interactive content creation, task management, e-portfolio development, and display of work via blogs, and allows the use of open educational resources. All these features are complemented by a set of digital tools that support teaching and learning [43].

A. Sample

The study involved 120 teachers from Ahmet Yesevi University (Turkistan, Kazakhstan). They represented six faculties: 1) Theology; 2) Engineering; 3) Philology; 4) Sports and Culture; 5) Natural Sciences; 6) Economics, Management, and Law. Ten teachers from each faculty who volunteered to participate in the study were selected. All of them had graduate degrees and at least three years of teaching experience. Table 1 contains information about the participants.

The participants were further divided into 3 groups according to work experience, which is extremely important in teaching. In the course of registration for participation in the study, educators supplied details about their tenure within the field of education exclusively as instructors. Subsequently, this information underwent meticulous scrutiny to affirm its precision and authenticity, encompassing cross-referencing with employment records and educational institution databases. Following the verification of data, instructors were categorized into groups based on the duration of their professional experience. Thus, Group A included teachers with 3–9 years of experience; Group B consisted of teachers with 10–20 years of experience; and Group C-teachers with 20+ years of experience. The selection of participants for the research was conducted based on clearly defined criteria of professional tenure, thereby ensuring the representation of diverse levels of professional experience among participants. This was pivotal for the judicious allocation of individuals into groups for the analysis of the impact of Personal Learning Environments (PLE) on the development of their professional competencies. Participation in the study was voluntary and the teachers were guaranteed non-disclosure of their data.

Table 1. Participant data

Group	Total	Gender	Number of participants	Percentage	Average experience (M)	SD	Average age (M)	SD
Group A	39	Men	12	30.8	7.24	3.06	35.06	2.34
		Women	27	69.2	8.12	2.74	36.19	2.86
Group B	44	Men	14	31.8	14.87	4.54	43.29	5.09
		Women	30	68.2	15.03	4.33	44.97	6.17
Group C	37	Men	16	43.2	24.09	3.57	56.14	3.44
		Women	21	56.8	25.39	4.61	53.17	5.32

B. Study Design

A PLE Web 2.0 intervention program based on the e-me educational platform was developed specifically for the current study. The purpose of the intervention was to improve the high-quality competencies of university teachers (Table 2). The program focused on each of the examined competencies.

The program outlines a comprehensive approach to the development of university teachers. It addresses each specific competence area through a range of resources and activities. Several stakeholders, namely teacher development teams, IT departments, and content curators, are crucial to its successful implementation. Mechanisms for regular evaluation and feedback were also integrated to ensure the effectiveness and smooth functioning of the program. Educators were granted access to an extensive repository of electronic textbooks and educational resources, encompassing video lectures and interactive assignments. Additionally, the e-me platform was implemented, facilitating participant interaction and knowledge exchange within an interactive environment. Tools for the creation and

modification of instructional programs, including templates and course design guides, were also made available to educators. The program included regular workshops and training sessions aimed at cultivating specific pedagogical skills. Coaching and mentoring sessions were organized, involving experienced educators and experts, providing opportunities for experience sharing and personalized feedback. Interactive seminars on self-development were conducted to enhance educators' personal qualities, including aspects such as emotional intelligence and stress resilience. To assess the intervention's effectiveness, educators crafted and presented portfolios comprising samples of instructional materials, lesson plans, practical exercises, and regularly conducted surveys and questionnaires.

Table 2. PLE intervention program

High-quality competencies	Implementation strategy	Activities
Personal qualities	Develop a self-discovery course for teachers	Self-discovery seminars, self-assessment exercises, peer feedback sessions
Pedagogical goal setting	Integrate best goal-setting practices into pedagogy courses	Modules, projects and seminars on setting and achieving goals in teaching practice
Student motivation	Conduct motivation trainings and seminars	Motivational trainings, student motivation seminars; monitoring and recognition of effective motivational practices
Information competence	Create a resource center for educational materials	Developing a central repository of resources; training teachers to use, update, and monitor resources
Development of educational programs and materials	Establish a center for the development of training programs and educational materials	Designing an online hub for programs and materials, encouraging teachers to exchange materials, conducting seminars on effective material development
Organization of pedagogical activities	Conduct classroom management and pedagogy seminars	Seminars on classroom management and effective teaching strategies; peer feedback

The training took place during the 2022–2023 academic year. It began in September when teachers were informed about the intervention program and were given five days to familiarize themselves with the e-me platform. Before the training, the teachers also completed the High-Quality Teacher Competencies Questionnaire (HQTCQ). In October, they began practicing on the e-me platform, on which educational materials had previously been uploaded. These materials, as well as activities described in the table above, were integrated using the e-me functionality. This approach allowed teachers to access relevant resources, participate in seminars, and complete assignments. All interactive seminars and trainings were conducted directly in e-me within groups (Hives). The teachers were able to join these sessions digitally, interact with coordinators, and collaborate with colleagues on goal setting, motivational strategies, and curriculum development. Moreover, e-me promoted collaboration between participants via discussion forums and shared spaces. The teachers provided feedback, exchanged experiences, and discussed effective teaching strategies. In total, the intervention included 12 seminars, 8 trainings, and weekly online meetings. There were 45 units of educational content for the teachers to interact with throughout the intervention period, which lasted until the end of the first semester (December). In the second semester, the teachers were expected to implement the acquired knowledge in their practice. Their competencies were also expected to improve. A post-training survey based on the HQTCQ was conducted in early June 2023.

C. Data Analysis

The current study used IBM SPSS Statistics analytical software for statistic calculations. Specifically, the Jonckheere-Terpstra test and the Wilcoxon signed-rank test were used.

D. Ethical Issues

The study organizers obtained voluntary consent from all participants. The ethics committee of the Ahmet Yesevi University also gave its permission to conduct the study. The confidentiality of participants' data was ensured.

IV. Results

The six examined competencies of teachers differed depending on their work experience. Table 3 presents statistical data of three teacher groups calculated using IBM SPSS Statistics. The nonparametric Jonckheere-Terpstra test was additionally calculated to establish the statistical significance of the values.

The asymptotic significance reflects the difference in the development of teachers' competencies depending on their work experience. In general, Group B had higher mean values than Group A, especially in personal qualities, goal setting, and development of programs and materials. Such results may be associated with a more substantial teaching experience of Group B participants. On the other hand, Group C had higher mean values in some competencies, such as personal qualities and goal setting. However, Group C was still behind Group B in terms of student motivation and organization of pedagogical activities.

Table 4 describes the results of the post-training survey conducted at the end of the 2022–2023 academic year. The results show that after training in a personal learning environment, the teachers improved their competencies and were able to apply them during the second semester. The post-assessment of competencies also involved the calculation of the Jonckheere-Terpstra test.

As we can see, teachers of Group A were able to improve all their competencies as a result of working in a PLE. The competency values of Group B participants also increased compared to the pre-test results. Group C experienced the smallest increase in mean values. The Jonckheere-Terpstra test showed that after the intervention, the teaching experience did not play as big of a role as it did at the beginning. The statistical significance between the three groups remained in only half of the subscales: student motivation, information competence, and organization of pedagogical activities. Overall, the training improved the competencies of teachers in all three groups. However, Groups A and B benefited more from the PLE intervention than Group C.

Table 3. Statistical data of basic teacher competencies (pre-test)

		Personal qualities	Pedagogical goal setting	Student motivation	Information competence	Development of educational programs and materials	Organization of pedagogical activities
Group A (3–9 years of experience)	Mean	24.00	23.16	28.53	30.00	22.53	31.47
	Standard deviation	3.145	1.259	1.264	1.453	2.010	0.905
	Median	24.00	23.00	29.00	30.00	23.00	31.00
	Dispersion	9.889	1.585	1.596	2.111	4.041	0.819
	Kurtosis	−1.442	0.149	−1.707	−1.240	−1.609	−0.499
	Skewness	0.252	0.604	−0.066	0.000	−0.181	0.339
Group B (10–20 years of experience)	Mean	28.48	29.14	27.67	28.38	29.90	29.62
	Standard deviation	1.327	1.852	1.155	1.117	2.548	1.532
	Median	29.00	30.00	28.00	28.00	30.00	29.00
	Dispersion	1.762	3.429	1.333	1.248	6.490	2.348
	Kurtosis	−1.355	−2.010	−1.449	−1.202	−0.949	−0.469
	Skewness	−0.298	−0.126	−0.128	0.330	−0.023	0.719
Group C (20+years of experience)	Mean	29.10	31.20	23.35	28.40	29.35	25.90
	Standard deviation	1.804	1.908	1.631	1.188	1.137	1.553
	Median	29.00	31.50	24.00	29.00	30.00	26.00
	Dispersion	3.253	3.642	2.661	1.411	1.292	2.411
	Kurtosis	−1.129	−1.085	−0.469	−1.576	−1.508	−1.451
	Skewness	0.134	−0.267	−0.552	−0.050	−0.065	0.184
Asymptotic significance (2-sided)		**0.000**	**0.000**	**0.000**	**0.002**	**0.000**	**0.000**

Table 4. Statistical data of teacher competencies after the training (post-test)

		Personal qualities	Pedagogical goal setting	Student motivation	Information competence	Development of educational programs and materials	Organization of pedagogical activities
Group A (3–9 years of experience)	Mean	29.68	29.53	31.37	32.95	28.11	34.37
	Standard deviation	1.600	1.896	1.165	0.911	1.197	1.012
	Median	30.00	30.00	31.00	33.00	28.00	34.00
	Dispersion	2.561	3.596	1.357	0.830	1.433	1.023
	Kurtosis	−1.470	−1.513	−1.321	−1.881	−1.124	−0.890
	Skewness	0.307	−0.045	0.356	0.112	0.646	0.221
Group B (10–20 years of experience)	Mean	32.24	32.95	30.76	33.52	32.86	35.14
	Standard deviation	2.234	1.161	0.831	1.167	1.740	0.854
	Median	32.00	33.00	31.00	34.00	33.00	35.00
	Dispersion	4.990	1.348	0.690	1.362	3.029	0.729
	Kurtosis	−1.330	−1.287	−1.364	−1.445	−0.998	−1.588
	Skewness	−.211	−0.535	0.496	−0.168	−0.010	−0.294
Group C (20+ years of experience)	Mean	29.40	31.75	25.20	28.70	29.30	27.55
	Standard deviation	1.569	1.293	1.322	1.261	1.031	1.099
	Median	29.50	31.50	26.00	29.00	29.00	28.00
	Dispersion	2.463	1.671	1.747	1.589	1.063	1.208
	Kurtosis	−0.800	−0.638	−1.370	−1.526	−0.945	−1.205
	Skewness	0.251	0.518	0.201	−0.417	0.282	−.273
Asymptotic significance (2-sided)		0.665	0.011	**0.000**	**0.000**	0.156	**0.000**

Table 5. Wilcoxon test scores

Group		Personal qualities	Pedagogical goal setting	Student motivation	Information competence	Development of educational programs and materials	Organization of pedagogical activities
Group A (3–9 years of experience)	Z	−3.753	−3.836	−3.863	−3.638	−3.830	−3.841
	Asymptotic significance (2-sided)	0.000	0.000	0.000	0.000	0.000	0.000
Group B (10–20 years of experience)	Z	−3.692	−3.838	−4.040	−4.038	−3.519	−4.037
	Asymptotic significance (2-sided)	0.000	0.000	0.000	0.000	0.000	0.000
Group C (20+years of experience)	Z	−0.373	−0.880	−2.060	−0.808	−0.116	−2.931
	Asymptotic significance (2-sided)	0.709	0.379	0.002	0.419	0.908	0.003

The third and final objective of the current study was addressed using the Wilcoxon signed-rank test. Specifically, we calculated the statistical significance of differences in pre-test and post-test results. The obtained data are presented in Table 5.

According to the given table, the PLE-based practice was extremely effective for less experienced teachers, as confirmed by the significance of pre-test and post-test differences. The only statistically significant subscales for teachers with more than 20 years of experience were student motivation and organization of pedagogical activities. Thus, the intervention was able to increase only the lowest pre-test values of Group C. These results show that more experienced teachers need to better motivate students and integrate more innovative approaches into their teaching practice.

V. Discussion

The differences in baseline teacher competencies can be explained by several factors. Firstly, teachers with different experiences may implement different training methods that directly affect their competencies. Secondly, it is possible that more experienced teachers have a certain degree of confidence in their skills and may not see the need for additional training. Moreover, differences in competencies may be due to over-time changes in teaching requirements and practices. More experienced teachers may not always be able to quickly adapt to new approaches. Differences in competencies due to experience have been reported in one of the previous studies [44]. Next, we can analyze each high-quality competence in more detail and draw appropriate conclusions. Thus, teachers in Groups A and B improved their personal qualities. Perhaps this was due to the new knowledge and approaches provided by the PLE training. In contrast, the most experienced teachers in Group C displayed more persistent behavior and were less inclined to change their usual methods. The PLE training helped teachers in Groups A and B to define educational goals more clearly and plan lessons with a clearer structure. This factor confirms the effectiveness of the PLE, especially for Group A participants, who have only recently begun their teaching practice. On the other hand, more experienced teachers already exercised several stable practices and were not ready for such rapid change. Also, teachers from all three groups strengthened their skills in motivating students using the presented PLE strategies. In this case, teachers of Group B were able to achieve the best results since they had a lot of experience, but at the same time, there was room for improvement. Training in the PLE contributed to more effective search, analysis, and use of information in the educational process. It also helped the teachers of Groups A and B to improve their competence in developing educational programs and materials. Less experienced teachers were able to more successfully master the new development methods since their previous methods were more flexible. Finally, the PLE training allowed the teachers to more effectively organize the learning process, design interactive lessons, and respond to student needs. To sum up, teachers with average experience (10–20 years) adapted to new methods more easily, since they had fewer established practices and a broad scholarly background.

Positive experiences with personal learning environments have been previously reported in many studies. Thus, one of the scientific works [2] suggested that teachers can increase students' ability to master new knowledge using Web 2.0 technologies. Another study [5] proposed a model for enhancing educational communication activities and teaching in primary schools. The results showed a considerable improvement in all aspects of communication activities after using Web 2.0 apps. Similarly, a study [7] examined student-created Personal Learning Environments (PLEs) based on Web 2.0 services in higher education. As a result, PLEs were found to be effective tools for learning and acquiring skills, strengthening social interactions, and improvement in the organization and management of content and learning resources [7]. Another recent study [8] found that PLEs facilitate academic learning for students. The authors also report that designing a PLE is a complex task based on the technological and social skills of the user. A research paper [20] described a content analysis of scientific articles aimed at identifying the components of a personal learning environment. The paper also proposed an ontology-driven conceptual model that comprised four dimensions: personal, technological, organizational, and social, as well as teaching and learning. Also, one of the research papers [21] described a study that attempted to integrate a Learning Management System (LMS) with a personal learning environment for training higher education teachers. The authors surveyed teachers regarding the value and flexibility of the developed training platform. The results showed improvements in the teachers' skills, self-regulated learning competency, and ICT literacy [21].

To ensure precise data interpretation in the study, it is crucial to consider that the results were based on teacher self-assessments through a questionnaire, implying that subjective evaluations could influence the outcomes. Furthermore, the sample size and the use of only the English version of the educational platform may limit the generalizability of the results. Additionally, it should be noted that the concept of high-quality teaching competencies may be subject to varied interpretations depending on the educational context and pedagogical practices.

VI. Conclusions

Teachers with 10–20 years of experience (Group B) had higher mean competency values than less experienced teachers (Group A). The difference was especially noticeable in personal qualities, goal setting, and development of programs and materials. Group C participants had better-developed competencies overall but were behind Group B in some aspects. Practice on the e-me platform allowed teachers of Groups A and B to significantly improve all their competencies. However, in Group C, the increase was significant only in student motivation and organization of pedagogical activities. The findings suggest that PLE training is most effective for educators with moderate tenure (10–20 years), as teachers with intermediate experience demonstrate greater adaptability to new methods. A technology-based learning environment can assist teachers in comprehensively enhancing their competencies, enabling them to become more adaptive to changes.

From a scientific perspective, the study sheds light on how

technology-based learning environments can impact teacher competencies and provides empirical evidence of the effectiveness of PLE applications in promoting the development of high-quality competencies. The scope of the findings extends to educational institutions at all levels, teacher training programs, and organizations involved in teacher professional development.

The results of this study must be interpreted with caution and some limitations should be borne in mind. Thus, the study utilized only the English version of the e-me platform. This factor could indirectly lower the effectiveness of the training. The respondent sample was also relatively small, which complicated the extrapolation of the results. Furthermore, the current self-report tool has not been used in other studies, which may be another limitation. Finally, the very concept of "high-quality teacher competencies" may act as a limitation since it can be interpreted differently depending on the type of teacher activity. Furthermore, the instructional methods employed within the current Personal Learning Environment (PLE), including seminars, self-awareness courses, and resource centers, played a significant role in competency development. However, these methods are not standardized and may vary depending on the intervention programs. Additionally, the level of confidence among educators in their abilities, which may vary based on experience, could influence their engagement, effectiveness, and derived benefits from the training. Lastly, changes in teaching requirements and practices, particularly in the context of digital technologies and Web 2.0, could impact teachers' adaptability and responsiveness to PLE training.

Appendix

- High-Quality Teacher Competencies Questionnaire (HQTCQ)

Personal qualities

1. I believe that I demonstrate a high level of respect for my students.
2. I believe that I have a strong general pedagogical culture.
3. I organize my work effectively.
4. I feel motivated and enthusiastic about my teaching career.
5. I can empathize with the needs and perspectives of my students.
6. I prioritize organization in my teaching practice.
7. I consider myself culturally competent and value diversity in the classroom.
8. I believe that I use reflective practices in my teaching.
9. I am able to create a positive and respectful learning environment.
10. I strive to constantly improve my teaching abilities.

- Pedagogical goal setting

11. I am able to set clear educational goals for my students.
12. I can create a compelling image of desired learning outcomes.
13. I effectively monitor my students' progress toward their goals.
14. I provide detailed descriptions of ways to achieve the desired results.
15. I understand the system of educational requirements and can explain it to my students.
16. I am able to adapt educational goals to the individual needs of students.
17. I believe in my ability to align educational goals with the curriculum.
18. I regularly analyze the performance of my students.
19. I clearly communicate learning objectives to my students.
20. I am able to create specific learning outcomes for each lesson.

- Student motivation

21. I am able to create a motivating learning environment.
22. I understand and effectively apply the various components of student motivation.
23. I use positive reinforcement to motivate my students.
24. I am able to encourage students using my teaching methods.
25. I manage to develop students' intrinsic motivation.
26. I adapt my motivational strategies to the individual needs of students.
27. I maintain student interest throughout the entire learning process.
28. I encourage students to take responsibility for their learning.
29. I use various incentives to motivate my students.
30. I believe that I maintain intellectual motivation among my students.

- Information competence

31. I have extensive knowledge of my subject.
32. I efficiently process information and make it easy to understand.
33. I adapt my teaching methods to convey information as effectively as possible.
34. I understand the psychological characteristics of my students.
35. I develop positive teacher-student relationships.
36. I adapt my teaching to the individual needs of students.
37. I use educational resources to support my teaching.
38. I am always aware of events and developments that occur in my subject area.
39. I ensure that my training materials are accurate and up to date.
40. I adapt my teaching methods to different learning styles.

- Development of educational programs and materials

41. I am able to develop educational programs that meet learning objectives.
42. I create teaching materials that improve student learning outcomes.
43. I make decisions that take into account the diverse needs of students.
44. I effectively integrate technology into educational programs.
45. I use innovative teaching methods to engage students.
46. I adapt my teaching materials to the needs of my students.
47. I give clear instructions on educational activities.

48. I develop educational materials that are relevant and up-to-date.
49. I use formative assessment to adjust educational programs.
50. I believe that I am capable of making effective pedagogical decisions.

- Organization of pedagogical activities

51. I am able to establish effective relationships with my students.
52. I constantly communicate and interact with my students.
53. I successfully regulate students' activities during classes.
54. I evaluate student performance and provide feedback.
55. I always try to create a positive and inclusive learning environment.
56. I manage class dynamics and effectively maintain discipline.
57. I adapt my teaching style to the needs of students.
58. I use technology to facilitate classroom learning.
59. I encourage student participation and involvement.
60. I support students who require additional assistance.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

G.I.-Conceptualization, Methodology, Resources, Writing–Original Draft Preparation, and Validation. Z.Y.-Software, Formal Analysis, Data Curation, Writing–Review & Editing, and Validation. S.A.-Methodology, Investigation, Resources, Funding Acquisition, and Validation; all authors had approved the final version.

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