

Beyond the Metrics: Exploring the Dynamics of Student Engagement in Online Lifelong Learning

Buket Kip Kayabaş^{1,*} and İlker Kayabaş²

¹ Lifelong Learning and Adult Education Department, Faculty of Education, Anadolu University, Eskişehir, Türkiye

² Open and Distance Learning Department, Faculty of Open Education, Anadolu University, Eskişehir, Türkiye

Email: bkip@anadolu.edu.tr (B.K.K.); ikayabas@anadolu.edu.tr (I.K.)

*Corresponding author

Manuscript received March 23, 2026; revised April 15, 2026; accepted May 15, 2026; published September 21, 2026

Abstract—Despite the consensus that student engagement drives online learning success, existing research relies heavily on superficial log data from undergraduate or emergency remote teaching contexts. This leaves a critical gap in understanding the profound psychological and social dynamics of adult learners in voluntary, lifelong learning environments. To address this, the current study employed an explanatory sequential mixed-methods design to investigate the engagement profiles of adult learners in a fully online vocational certificate program. Quantitative data collected from 521 active professionals revealed a moderate overall engagement level, uniquely characterized by high cognitive and emotional involvement but surprisingly low social participation. Subsequent qualitative thematic analysis ($n = 131$) illuminated the reasoning behind these metrics: highly educated and older adult learners exhibited strong self-regulation and an emotional connection to the practical utility of the content. However, they actively engaged in preferred social isolation, viewing mandatory peer interaction and forums as a hindrance to their independent study strategies. Conversely, learners with emerging academic autonomy relied heavily on social presence and peer support. Furthermore, certificate attainment functioned holistically as both an intrinsic marker of professional competence and an extrinsic career catalyst. These findings challenge the traditional one-size-fits-all interaction paradigm in online education, advocating for flexible, autonomy-driven instructional designs that transcend mandatory social presence and cater to the diverse profiles of lifelong learners.

Keywords—student engagement, lifelong learning, online learning, distance education

I. INTRODUCTION

Digital transformation has carried learning processes beyond physical boundaries, shifting education into a dynamic lifelong learning paradigm. In this context, lifelong learning refers to the continuous, self-motivated pursuit of knowledge for personal or professional reasons, where online certificate programs serve as a primary vehicle for non-formal education. Unlike traditional degree programs, online certificate programs provide flexible educational opportunities that individuals of all ages can access whenever and wherever they need accurate information, free from formal prerequisites [1]. Consequently, these programs appeal to a highly diverse demographic, including individuals without prior university access, professionals seeking to expand their expertise into new domains, and entrepreneurs aiming to acquire specific practical competencies [2].

In the 21st century, the rapidly changing demands of the labor market have made the continuous updating of individuals' personal and professional skills a necessity

rather than a choice [3]. Fully online certificate programs, which largely eliminate time and space constraints for both learners and instructors, stand out as one of the most innovative solutions, particularly in adult education. Achieving learning objectives in online programs, which offer a high degree of flexibility, is largely contingent upon students taking responsibility for their own learning and actively participating in the process.

However, despite the flexibility and accessibility of online lifelong learning, a persistent global challenge threatens its success: the lack of social interaction and the resultant sense of isolation among adult learners. International research consistently demonstrates that this lack of social connectivity is not a localized institutional issue, but a worldwide phenomenon affecting learners across diverse educational models, including international MOOCs and broad distance education programs [4]. Globally, adult learners often struggle to establish a sense of community due to competing professional and personal responsibilities, a structural constraint that frequently leads to decreased motivation and elevated dropout rates [5]. Therefore, addressing the social isolation of adult learners must be approached as a universal educational priority rather than a campus-specific problem.

Student engagement is the primary factor that most significantly enhances students' academic success [6–9] and learning satisfaction [10] in online learning, while simultaneously reducing the sense of isolation [11]. Empirical evidence consistently suggests that without high levels of engagement, the lack of physical presence in digital environments often leads to cognitive detachment and higher attrition rates [5]. Given the technology-mediated nature of online learning, traditional definitions of student engagement require a specific reconceptualization. In this study, student engagement is operationalized based on the Online Student Engagement framework developed by Dixon (2010, 2015). According to Dixon, online engagement is not merely about mechanical data like login frequencies. Instead, it is defined by the quality of a student's academic and social investments within the learning community. This model offers a multidimensional perspective. It encompasses individual strategies such as note-taking (Skills), professional interest in the content (Emotion), interaction with peers and instructors (Participation), and a focus on academic achievement (Performance). Consequently, engagement is approached as an indicator of learners' active presence in the online ecosystem, going far beyond simple digital footprints.

Although student engagement has been extensively investigated in the educational literature, existing studies have predominantly been conducted at the undergraduate

level [12], within single courses such as project-based training [13, 14], or in contexts where students share highly similar demographic characteristics. Furthermore, recent studies have largely focused on emergency remote teaching programs established during the COVID-19 pandemic [15–19]. Research conducted within this context falls short in accurately assessing students' genuine online learning experiences, the digital infrastructure deficiencies of the systems, and the cultural capacities of institutions, as these were rapid interim measures rather than fully structured distance education programs [20, 21]. There is a pressing need for research that investigates the dynamics of online lifelong learning programs in which individuals participate entirely of their own free will, absent the compulsory pressures of periods like the pandemic.

Many contemporary studies attempt to explain online engagement quantitatively. They often rely exclusively on mechanical log records, such as login frequencies or time spent on the system [22–24]. However, this purely statistical approach is structurally insufficient to dissect such a complex phenomenon. Quantitative survey data can reveal current engagement levels or identify demographic differences. Yet, numbers alone fail to explain why adult learners make specific choices. For instance, statistical scores cannot clarify why highly educated learners intentionally avoid social interaction. They also cannot reveal how working adults navigate their sense of belonging amidst competing professional duties. Therefore, it is crucial to move beyond superficial measurements. Conducting an in-depth investigation utilizing an explanatory sequential mixed-methods design allows for a more holistic understanding. This approach uses the qualitative exploration of learners' perceptions and reflections to explain the trends identified by the initial quantitative data. Ultimately, it offers a holistic and meaningful understanding of online engagement dynamics. Furthermore, to understand the structural roots of engagement, this study deliberately focuses on fundamental demographic variables (age, gender, educational level, and prior online experience). While intrinsic factors like individual motivation are undoubtedly important, analyzing these specific socio-demographic and experiential variables is crucial for identifying which exact learner profiles are most vulnerable to online isolation.

The overarching aim of this research is to determine the student engagement levels of adult learners participating in fully online certificate programs within the scope of lifelong learning, to examine these levels across various variables, and to reveal their profound experiences throughout this process. In alignment with this aim, the research seeks to explicitly answer the following Research Questions (RQs):

RQ1: What are the general engagement levels of adult learners participating in online certificate programs?

RQ2: Do students' engagement levels differ significantly based on demographic variables (age, gender, educational level) and prior online learning experience?

RQ3: How do the qualitative reflections of online certificate program students regarding their study strategies, sense of belonging, interaction dynamics, and perceptions of success explain their quantitative engagement scores?

II. LITERATURE REVIEW

This section presents an overview of the existing literature

on student engagement in online learning within the context of lifelong learning.

A. Lifelong Learning and Online Certificate Programs

Digital transformation has introduced new dimensions to education, propelling learning processes beyond physical classrooms, creating fundamental changes in the very nature of adult education. Examining its historical development, distance education practices, which began with correspondence courses, evolved through radio and television, and ultimately expanded to computer networks [25, 26]. With the rapid advancement of internet technologies and the widespread adoption of openness in education, open educational resources emerged. Open educational resources enable barrier-free access to knowledge on a global scale, from anywhere and at any time [27, 28]. These developments have liberated education from being a traditional process compressed into a specific age range. Instead, they have positioned a dynamic, continuous lifelong learning paradigm at the core of modern education, compelling individuals to adapt to the rapidly changing requirements of the era and to continuously develop their competencies [29–31].

Traditional higher education systems are predominantly strictly bound to hierarchical structures in terms of time, space, and administration. Lifelong learning, however, distinctively diverges from this rigid framework through the flexibility, autonomy, and accessibility it offers [26, 32]. Today's rapidly evolving labor market expectations have transformed the continuous updating of professional skills from a mere preference into an absolute necessity for individuals [3, 29, 33]. Massive Open Online Courses (MOOCs) and online certificate programs, structured within the scope of openness in education and online learning, directly respond to these personal and professional needs [34, 35]. The surging demand for skill-oriented programs that eliminate geographical barriers and academic prerequisites stands among the most innovative applications of modern adult education, fostering equal opportunities.

Thanks to their flexible structures, fully online certificate programs differ significantly from traditional educational opportunities in terms of motivational factors. Analyzed through the lens of Self-Determination Theory, learners in degree-oriented traditional structures are generally driven by extrinsic motivational sources [36, 37]. Systemic pressures such as grade anxiety, the necessity to pass a course, and the expectations of instructors or institutions are the primary elements guiding the learning action in traditional education [13, 36–38]. Conversely, lifelong learners participating in online certificate programs assume the responsibility for their own learning processes, experiencing a high degree of self-directed learning [39–42]. The participation of adult individuals in lifelong learning activities is not rooted in an extrinsic factor, but rather in intrinsic motivation directed toward personal curiosity, intellectual growth, and the fundamental need to access knowledge [36, 42]. The functional relevance of the enrolled training program to career goals and its utilitarian value in the real world constitute the most potent elements that ensure lifelong learners' engagement with the course and prevent them from giving up in the face of adversity [38]. Lifelong learners are not passive recipients of knowledge; rather, they

are the architects of their own professional and intellectual developmental journeys.

B. The Concept of Student Engagement in Online Learning

Student engagement is a construct that represents the learner's psychological, physical, and mental involvement in the learning process to achieve educational goals during their studies [15, 43]. Bond *et al.* [44] conceptually define student engagement as "the energy and effort that students employ within their learning community, observable via any number of behavioral, cognitive or affective indicators across a continuum" (p. 3).

Originally rooted in traditional learning environments and adapted to online learning by Fredricks *et al.* [45], this concept is examined across three fundamentally interactive dimensions: behavioral, cognitive, and affective (emotional). When adapted to online learning, the dimensions of this construct acquire digital characteristics. Behavioral engagement encompasses observable actions such as active participation in online classes, timely completion of assignments, time spent on the system, and adherence to rules [46–53]. Cognitive engagement denotes the student's self-regulation skills in the online environment, their effort to comprehend complex concepts, and their utilization of deep learning strategies [47–49, 54, 55]. Affective engagement, conversely, encompasses the student's psychological responses such as a sense of belonging, excitement, interest, and satisfaction during their interactions with the digital learning environment, the instructor, and peers [56].

Cultivating engagement in online learning necessitates equipping learning environments with robust and structured interaction opportunities [57]. Moore's [58] theory of interaction delineates three fundamental types of interaction that form the foundation of online engagement: learner-content, learner-instructor, and learner-learner interaction. Learner-content interaction [56] directly nourishes cognitive engagement by supporting the learner's process of understanding course materials and reorganizing their mental schema. Learner-instructor interaction [59] fosters behavioral and affective engagement through the instructor's immediate feedback, guidance, and support. Learner-learner interaction [60], on the other hand, mitigates the feeling of online isolation [11], promotes collaborative learning, and reinforces social communication and affective engagement.

Another construct explaining online engagement within the context of interaction is the Community of Inquiry (CoI) model developed by Garrison *et al.* [61]. The model is structured upon three core elements: teaching presence, social presence, and cognitive presence [61, 62]. Social presence establishes the foundation for affective engagement by enabling students to feel like part of a trust-based online community. Meanwhile, cognitive presence enhances cognitive engagement by allowing students to construct meaning through sustained communication and utilize shared metacognition skills. Teaching presence orchestrates the design and direction of the process, thereby simultaneously managing the student's behavioral, cognitive, and affective engagement levels within the online ecosystem.

C. Dimensions of Online Engagement: Skills, Emotion, Participation, and Performance

Student engagement in online learning has been

investigated across four main dimensions. According to the model developed by Dixson [63], online student engagement is built upon four interactively related core factors: 1) Skills, 2) Emotion, 3) Participation, and 4) Performance. The first dimension of online engagement, skills, delineates the student's actions and individual effort within learning environments [64, 65]. Studying regularly throughout the instruction, acting with a plan, reading course materials attentively, and tracking resources are at the core of this dimension. Students' success in online learning depends on the consistent execution of self-directed skills.

The second dimension, emotion, reflects the student's psychological attachment to online learning [64]. This dimension signifies not only the comprehension of the content to be learned but also the effort to apply acquired knowledge to daily life and an intrinsic willingness toward learning. Learners finding the course interesting, feeling excitement toward a new idea, and enjoying the learning process directly and robustly augment their engagement with online learning.

The third dimension, participation, which centers on the social nature of learning, represents students' communicative activities with each other and the instructor in online learning [64]. Actions such as actively participating in online forums, sharing ideas in group discussions, and contributing to peers' posts constitute the participation dimension. These social interactions dispel the feeling of online isolation, fostering trust [8] and a sense of belonging [64] regarding the online learning process among students.

The final dimension of the model, performance, focuses directly on academic goals and positive learning outcomes. Students' drive to succeed according to defined evaluation criteria, their expectation of receiving a good grade, and their desire to prove academic competence define the performance dimension. Research indicates that learning engagement increases success [6–9, 66], motivation, and satisfaction [10]. The four-dimensional online learning engagement model comprises a structure that investigates students' active participation in the online learning process, rather than evaluating them merely based on their presence in the system or their login frequencies.

D. Factors Affecting Engagement in Lifelong Learners

Lifelong learners require a high degree of autonomy, especially in online environments [42]. In the online education model, devoid of a traditional classroom structure, autonomy strictly necessitates possessing self-regulation skills [41]. During the learning process, adult learners must set their own goals, select their strategies, and effectively manage their progress [67]. Self-regulation in online learning is one of the primary elements supporting academic engagement [68–71].

In addition to self-regulation skills, learners are expected to be competent in digital literacy to actively participate in online learning environments [72]. Computer and internet self-efficacy reflects learners' self-confidence in their interactions with technology [73]. Individuals with high self-efficacy participate in learning activities without surrendering to technical obstacles, adapt to the system more rapidly, and maintain strong engagement with the course [42, 74].

Adult learners frequently have to balance family and educational responsibilities while simultaneously working at a job [75–77]. These multiple roles complicate the establishment of work-life balance and create constant time constraints. The physical isolation inherent in online learning can further exacerbate the stress generated by these multiple roles [78]. The concept of social presence [79–81], which bridges the transactional distance, assumes a critical role in this context. The learner must establish trust-based, sincere communication not only with the content but also with the instructor and peers. Designing learning environments effectively to foster a perception of social presence helps eliminate the feeling of loneliness behind the screen. It enables learners to feel a sense of belonging to the online community and directly enhances engagement [78].

In synthesis, prior research extensively details lifelong learning and engagement frameworks independently. However, there remains a critical need to integrate these concepts to understand the unique online experiences of adult learners. Traditional interaction models emphasize social presence to prevent isolation. Conversely, lifelong learners in certificate programs face a distinct paradox. Their pedagogical need for interaction often conflicts with a structural need for autonomy and time efficiency due to competing life roles. Current literature is largely descriptive and relies predominantly on undergraduate samples or superficial log data. Therefore, it fails to analytically address how adult learners navigate this tension. This study directly addresses this research gap. It connects Dixon's multidimensional engagement framework with the specific realities of adult learners. Consequently, this research establishes a coherent conceptual foundation. It explores not just the extent of their engagement, but analytically uncovers why they adopt specific interaction strategies like preferred social isolation to achieve their educational goals.

III. MATERIALS AND METHODS

A. Research Design

In this study, an explanatory sequential mixed-methods design was adopted to overcome the methodological limitations of investigating student engagement in online learning unidimensionally. The sequential mixed-methods design is a holistic research approach in which quantitative and qualitative data collection and analysis processes are conducted in consecutive, sequential phases [82]. In this research, the quantitative data obtained in the first phase were elaborated in depth by the qualitative data in the second phase, and in the final stage, all findings were integrated in a mutually explanatory manner [83]. Consequently, it became possible to interpret the underlying reasons behind general trends or statistical results revealed by quantitative data, as well as participant experiences, through qualitative data. Thus, the focus was placed on conducting an in-depth analysis of the underlying causes of the scale's sub-dimensions within the context of student experiences. In this explanatory sequential design, the qualitative phase was intentionally built upon the initial quantitative results to explain specific statistical trends (e.g., low participation scores) and uncover the underlying perceptions and reflections of adult learners.

By the nature of the research design, the study was structured in two fundamental phases: In the first phase, a web-based survey consisting of Likert-type items was administered to measure students' engagement levels and tendencies; in the second phase, interviews were conducted with a subsample group to interpret the quantitative findings from an in-depth perspective.

B. Participants

The study group of the research consists of lifelong learning adults enrolled in a vocational certificate program conducted entirely online by a public university. Table 1 presents the demographic characteristics of the 521 students who participated in the study.

Table 1. Demographic information of the participating students

Socio-Demographic Variable	Characteristic	f	(%)
Gender	Female	242	46.4
	Male	279	53.6
Age	18–29	130	25.0
	30–39	107	20.5
	40–49	182	34.9
	50–59	75	14.4
	60 and above	27	5.2
Education Level	High School	175	33.6
	Associate Degree	142	27.3
	Bachelor's Degree	142	29.4
	Graduate Degree	51	29.4
Distance Education Experience	Yes	313	60.1
	No	208	39.9

For the quantitative phase of the research, data were collected utilizing the convenience sampling technique. To ensure the reliability of the study context, specific eligibility criteria were established. Participants were required to meet three inclusion criteria: (a) being an adult learner (18 years of age or older), (b) being actively enrolled in a fully online vocational certificate program during the data collection period, and (c) providing informed voluntary consent to participate in the study. Based on these criteria, a total of 521 students participated in the questionnaire administration.

Examining Table 1, it is observed that the participants exhibit a balanced distribution in terms of gender, comprising 53.6% males and 46.4% females. In alignment with the context of lifelong learning, it was determined that a vast majority of the participants consist of adult learners, with 34.9% in the 40–49 age range and 20.5% in the 30–39 age range. In terms of educational level, it was found that 33.6% of the students are high school graduates and 29.4% hold a bachelor's degree. Additionally, it was identified that more than half of the participants, at a rate of 60.1%, had prior experience taking courses via distance education before the current certificate program. The participants consist entirely of actively working professionals across various sectors, such as education, healthcare, and business.

For the qualitative phase of the research, purposive sampling was utilized to identify a subset of participants from the initial quantitative cohort. It is important to clarify that qualitative data were not gathered through synchronous in-depth oral interviews. Instead, data were collected in Turkish via semi-structured, open-ended questions seamlessly integrated into the final section of the online survey. Of the initial 521 respondents, 131 individuals

($n = 131$) provided valid, detailed, and comprehensive written responses to these qualitative prompts. This asynchronous, written interview format was deliberately selected. It afforded adult learners the flexibility to reflect deeply on the questions and articulate their experiences comprehensively, free from the constraints and pressures of synchronous scheduling. Although this sub-sample ($n = 131$) involves an element of self-selection based on respondents' willingness to elaborate, this approach is methodologically appropriate for adult education where authentic reflections require voluntariness. To explicitly ensure the representativeness of this qualitative data, a comparative check was conducted. The demographic distribution of these 131 respondents closely matched the overall profile of the original 521 participants in terms of key characteristics,

indicating no significant participation bias and justifying the sub-sample's appropriateness.

C. Context

The context of the research is the Occupational Health and Safety Certificate Program, conducted entirely online within a public university in Turkey. The Certificate Program is a comprehensive educational program containing fundamental knowledge, legislative information, and field experiences oriented toward the occupational health and safety services that employers will implement in their own workplaces. The program consists of 12 modules designed in a fully online structure. Enrolled students are provided with audiovisual course materials via the learning management system (Fig. 1).

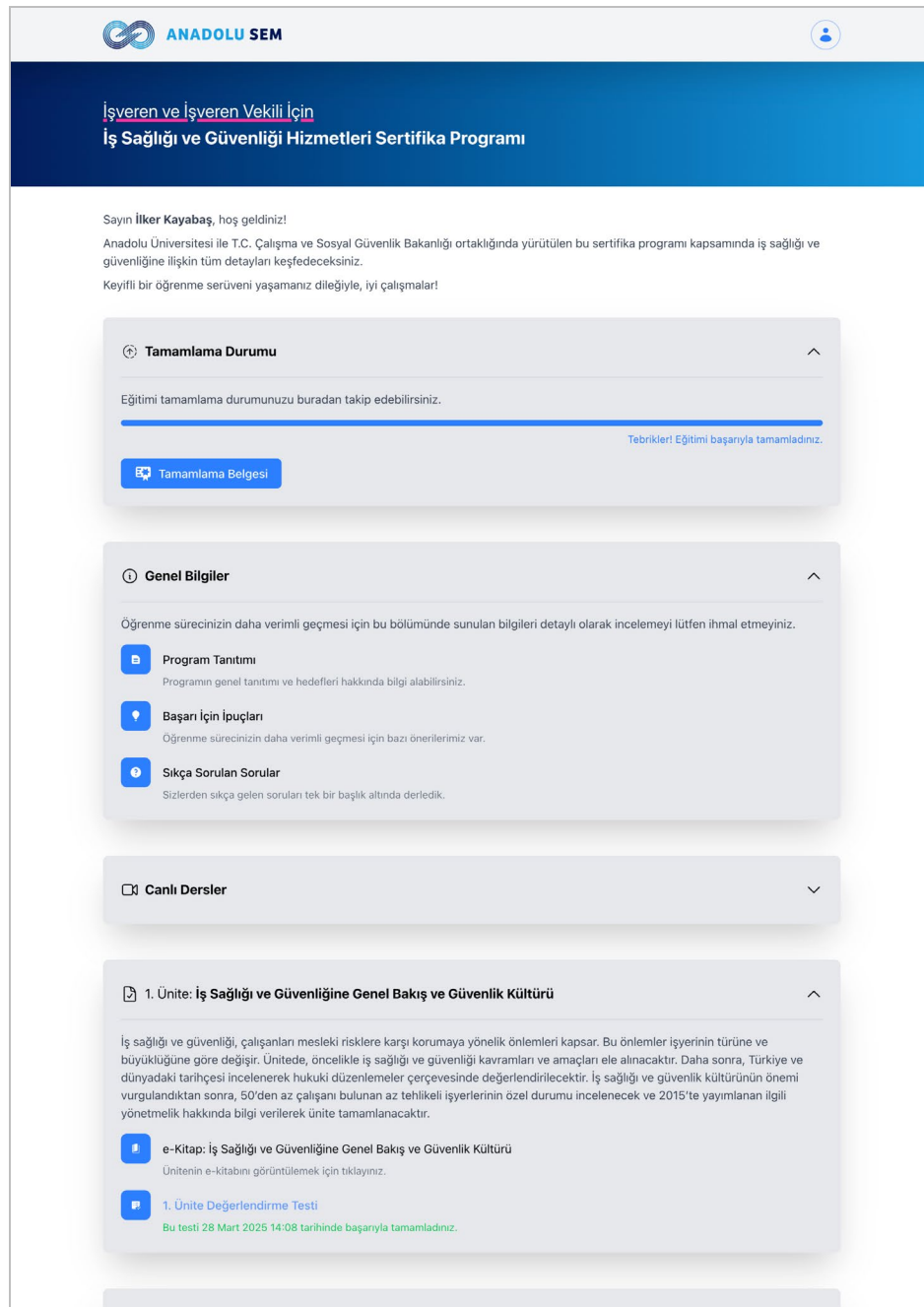


Fig. 1. Online certificate program learning environment.

To provide greater transparency regarding the research context, this study was conducted within a fully online

e-certificate program offered by Anadolu University, a mega-university known for its extensive open and distance

learning system. The learning environment is hosted on a specialized, Moodle-based Learning Management System (LMS) developed specifically for the Continuing Education Center. The program is structured as a 6-week course that integrates both synchronous and asynchronous opportunities, allowing adult learners the flexibility to engage with the content at their own pace. The instructional design includes a mix of weekly live synchronous classes, pre-recorded lecture videos, downloadable reading materials (PDFs), and

self-assessment quizzes (Fig. 2). Regarding peer and instructor interaction, the platform features asynchronous discussion forums designed for academic inquiries and social engagement. Furthermore, during the final segment of each weekly live class, students can receive academic support by synchronously asking questions to the instructor and their peers. Participation in the live classes and asynchronous forums is voluntary and does not constitute a mandatory grading criterion.



Fig. 2. Live class sessions and materials.

Faculty members who are experts in their respective fields and experienced in online learning conduct 3-hour live course sessions weekly in the Zoom video conference environment (Fig. 2). In the initial segment of the live classes, the instructor summarizes the topic of the week, shares insights on key points, and provides detailed explanations for subject matter deemed difficult to comprehend. Rather than direct lecturing, the classes emphasize the key points of the topics and feature Q&A activities with the active participation of the students. The primary objective is to enable students to obtain direct expertise on the weekly topic regarding the occupational health and safety services they will carry out in their workplaces. Through these Q&A sessions, other learners experiencing similar issues also receive direct, practical, sector-based consulting services. To accommodate working students who cannot attend the synchronous sessions and to ensure that all students can revisit the course content, recordings of the synchronous live sessions are uploaded to the system, providing 24/7 access.

The evaluation system in the certificate program is conducted through tests located at the end of each module

and assessment tools embedded within the units. Questions embedded within the unit appear according to the students' pace of progression and performance status. The assessment questions at the end of the unit, on the other hand, are unlocked once the student completes studying the respective unit. Students are deemed successful when they demonstrate a 70% completion rate in the certificate program, thereby qualifying to receive the program's certificate. The program certificate is dispatched to students in both digital and printed formats. Within the scope of the certificate program, there is an asynchronous forum environment where students can share information among themselves. Furthermore, a support service for technical and administrative matters is provided to students every day of the week via telephone and e-mail.

D. Data Collection Tools

In the research, two data collection tools were utilized: a questionnaire and a semi-structured interview form. The first measurement tool, prepared to collect quantitative data, consists of two sections. The first section of the questionnaire contains questions regarding the demographic information of

the students, while the second section comprises the Online Student Engagement Scale, developed specifically for fully online learning by Dixon [63] and adapted into Turkish by Polat *et al.* [65]. The scale consists of a total of 19 items encompassing four fundamental dimensions: 1) Skills (7 items), 2) Emotion (5 items), 3) Participation (5 items), and 4) Performance (2 items), measuring the cognitive, affective, and behavioral engagement of adult learners through a holistic approach. The scale utilizes a 5-point Likert-type grading system, ranging from 1 (“Does not describe me at all”) to 5 (Describes me completely”). In the original validation study, Cronbach’s α was reported as 0.86 [65]. The Cronbach’s α values calculated for the sub-dimensions are 0.88 for “Skills”, 0.90 for “Emotion”, 0.83 for “Participation”, and 0.88 for “Performance”. Qualitative data were collected using the second data collection tool, the semi-structured interview form. The form aimed to determine the students’ sense of belonging to the online community, their relationships with the instructor and peers, and their efforts toward academic tasks. The questions in the interview form were prepared by the researchers, and expert opinions were obtained after reaching a consensus.

E. Ethical Declaration

This research was conducted with the approval of the Anadolu University Ethics Committee, dated March 5, 2026 and protocol number 154746.

F. Data Analysis

In the data analysis, in accordance with the explanatory sequential mixed-methods design, quantitative data were analyzed first, followed by the analysis of qualitative data, and the obtained findings were subsequently integrated.

In the first phase of the analysis, the quantitative data obtained from the questionnaire were analyzed using SPSS 26. The Mann-Whitney U test was applied to determine whether students’ online learning engagement differed based on gender and prior distance education experiences. Subsequently, the Kruskal-Wallis H test was utilized to determine whether online student engagement differed in terms of age groups and education levels. In analyses where significant differences were detected, Dunn’s multiple comparison test, one of the post hoc analyses, was preferred to identify the source of the differences between groups.

In the second phase of the analysis, thematic analysis was employed to analyze the qualitative data obtained from the interview form to detail and explain the quantitative

findings [84]. NVivo 15 software was utilized in the data analysis. The Auto Codes feature of the NVivo software was used for data exploration and data-driven generation of main themes. The codes generated by the software were not evaluated as a final outcome; rather, an iterative process was conducted wherein the researchers engaged in deep and reflexive interaction with the dataset. The nodes obtained through automatic coding were reviewed line by line by the researchers. Codes that were repetitive, contextually overlapping, or formed a hierarchical integrity were merged. By taking into account both the explicit (surface) and implicit (latent) meanings in the participants’ statements, meaningful and comprehensive patterns (themes) were constructed from mechanical data clusters in line with the purpose of the research. Following the data reduction and structuring process, the data were coded under the themes of Individual Strategies, Functionality, Social Isolation, and Certificate-Orientedness. The engagement dimensions revealed by the quantitative findings were integrated with the themes in the qualitative findings and interpreted holistically.

To minimize subjectivity and ensure analytical rigor throughout this process, an investigator triangulation strategy was employed. Two researchers independently coded a random subset of the qualitative data using the established a priori framework. The inter-coder agreement was calculated using the Miles and Huberman (1994) [85] formula, resulting in an agreement rate of 88%. Given that values of 80% and above are considered indicators of high reliability in qualitative research, internal consistency was successfully achieved. Any minor coding discrepancies were resolved through collaborative consensus meetings to finalize the thematic map.

IV. RESULTS AND DISCUSSION

A. Quantitative Results

Within the scope of this research, the Cronbach’s α internal consistency coefficients were calculated as 0.98 for ‘Skills’, 0.96 for ‘Emotion’, 0.94 for ‘Participation’, and 0.92 for ‘Performance’. The overall engagement Cronbach’s α value was determined to be 0.97 (Table 2), indicating an excellent level of reliability. While such a high overall α value (0.97) points to potential item redundancy, the original 19-item structure of the validated scale was retained in its entirety to preserve established construct validity.

Table 2. Descriptive statistics, reliability, and normality test results of the student engagement scale

Dimensions	<i>n</i>	$\bar{x}$	<i>SD</i>	Skewness	Kurtosis	<i>W</i>	<i>p</i>	α
Skills	521	2.97	1.43	-0.10	-1.52	0.88	<0.001	0.98
Emotion	521	2.95	1.40	-0.02	-1.48	0.90	<0.001	0.96
Participation	521	2.14	1.21	1.14	0.22	0.83	<0.001	0.94
Performance	521	2.94	1.44	-0.02	-1.47	0.88	<0.001	0.92
Overall Engagement	521	2.74	1.16	-0.07	-1.39	0.92	<0.001	0.97

The measures of central tendency, internal consistency coefficients, and normality test results of the scores obtained by the participating students from the online engagement scale and its sub-dimensions are presented in Table 2. It was determined that the general engagement levels of the students participating in fully online certificate programs within the context of lifelong learning were at a moderate level ($M = 2.74$, $SD = 1.16$). When analyzed on the basis of

sub-dimensions, it is observed that the highest score belongs to the Skills ($M = 2.97$) sub-dimension; whereas the Participation sub-dimension ($M = 2.14$), which represents participation in forums and interaction, is considerably lower compared to the other dimensions. Furthermore, according to the Shapiro-Wilk test results, it was determined that the data did not exhibit a normal distribution across the entire scale and all sub-dimensions ($p < 0.001$). Therefore,

non-parametric analysis techniques were employed in the subsequent data analysis. The significance level for the analysis results was accepted as $p < 0.05$. An examination of skewness and kurtosis values further elucidates this non-normality. Notably, the Participation sub-dimension exhibited a strong positive skewness (1.14), indicating that the vast majority of learners clustered at the lower end of the

scoring spectrum for social interaction. This statistical skewness foreshadows the qualitative findings regarding adult learners' preferred social isolation.

Table 3 presents the results of the Mann-Whitney U test conducted to determine whether there is a significant difference between students' online engagement scores according to their gender.

Table 3. Comparison of student engagement by gender

Dimension	Gender	<i>n</i>	$\bar{x}$	<i>SD</i>	Mean Rank	<i>U</i>	<i>p</i>
Skills	Female	242	3.00	1.51	267.68	32,266.50	0.382
	Male	279	2.93	1.36	255.21		
Emotion	Female	242	2.94	1.48	261.13	33,727.50	0.986
	Male	279	2.95	1.34	260.89		
Participation	Female	242	2.24	1.31	266.17	32,507.50	0.461
	Male	279	2.06	1.11	256.51		
Performance	Female	242	2.99	1.45	265.84	32,587.50	0.489
	Male	279	2.89	1.44	256.80		
Overall Engagement	Female	242	2.78	1.25	267.68	32,143.50	0.346
	Male	279	2.70	1.08	255.21		

Examining Table 3, no statistically significant difference was found in the general engagement ($U = 32,143.50$, $p = 0.346$) and sub-dimension scores of the lifelong learners based on gender.

When examined in terms of another demographic characteristic, prior online learning experience, as seen in Table 4, whether students had distance education experience

prior to starting the program did not have a significant effect on their online engagement levels ($U = 32,006.50$, $p = 0.746$).

On the other hand, the results of the Kruskal-Wallis H test applied to examine the relationship between students' age groups and online student engagement are presented in Table 5.

Table 4. Comparison of student engagement by online education experience

Dimension	Online Education Experience	<i>n</i>	$\bar{x}$	<i>SD</i>	Mean Rank	<i>U</i>	<i>p</i>
Skills	Yes	313	3.02	1.39	264.97	31,308.50	0.458
	No	208	2.88	1.49	255.02		
Emotion	Yes	313	2.96	1.32	260.60	32,426.50	0.941
	No	208	2.92	1.52	261.60		
Participation	Yes	313	2.18	1.26	262.60	32,050.00	0.763
	No	208	2.08	1.13	258.59		
Performance	Yes	313	2.89	1.40	255.14	30,718.00	0.269
	No	208	3.01	1.51	269.82		
Overall Engagement	Yes	313	2.77	1.12	262.74	32,006.50	0.746
	No	208	2.70	1.23	258.38		

Table 5. Comparison of student engagement by age

Dimension	Age	<i>n</i>	Mean Rank	X^2	<i>p</i>
Skills	18–29	130	276.02	10.94	0.027
	30–39	107	220.60		
	40–49	182	274.01		
	50–59	75	254.75		
	60 and above	27	278.41		
Emotion	18–29	130	271.95	11.65	0.020
	30–39	107	216.93		
	40–49	182	273.84		
	50–59	75	270.92		
	60 and above	27	268.78		
Participation	18–29	130	254.60	1.33	0.857
	30–39	107	269.43		
	40–49	182	259.96		
	50–59	75	269.72		
	60 and above	27	241.20		
Performance	18–29	130	278.17	3.89	0.421
	30–39	107	245.16		
	40–49	182	265.19		
	50–59	75	246.45		
	60 and above	27	253.31		
Overall Engagement	18–29	130	275.46	5.42	0.247
	30–39	107	232.66		
	40–49	182	267.50		
	50–59	75	258.07		
	60 and above	27	268.04		

As seen in Table 5, there is no significant difference between the general online student engagement scores according to age groups ($X^2 = 5.42$, $p = 0.247 > 0.05$).

Although there was no significant difference in general engagement levels, it was observed that there was a significant difference in the engagement levels of the

scale's sub-dimensions, namely Emotion ($X^2 = 11.65$, $p = 0.020 < 0.05$) and Skills ($X^2 = 10.94$, $p = 0.027 < 0.05$). While the Kruskal-Wallis H test indicates a statistically significant difference between the groups, it does not explain which groups are the source of this difference. In cases where the data do not exhibit a normal distribution, it is recommended to use Dunn's test with Bonferroni correction to perform pairwise comparisons after the Kruskal-Wallis test and to keep Type I error under control [86].

According to the results of Dunn's multiple comparison test (post hoc) conducted to determine which age groups

exhibited significant differences in the Emotion and Skills dimensions of online engagement; in the context of age groups, it was determined that middle-aged participants in the 40–49 age range demonstrated a significantly greater effort compared to the 30–39 age group in associating the course with daily life (Emotion dimension) and studying with a plan (Skills dimension).

Finally, the results of the Kruskal-Wallis H test applied to examine the relationship between students' education levels and online student engagement are presented in Table 6.

Table 6. Comparison of student engagement by education level

Dimension	Education Level	n	Mean Rank	X ²	p
Skills	High School	175	237.59	9.24	0.026
	Associate Degree	142	266.68		
	Bachelor's Degree	153	267.73		
	Graduate Degree	51	305.33		
Emotion	High School	175	237.76	11.37	0.010
	Associate Degree	142	253.56		
	Bachelor's Degree	153	279.73		
	Graduate Degree	51	305.27		
Participation	High School	175	256.95	49.38	< 0.001
	Associate Degree	142	324.93		
	Bachelor's Degree	153	236.66		
	Graduate Degree	51	169.93		
Performance	High School	175	256.13	1.97	0.578
	Associate Degree	142	274.04		
	Bachelor's Degree	153	251.99		
	Graduate Degree	51	268.43		
Overall Engagement	High School	175	239.90	6.93	0.074
	Associate Degree	142	284.33		
	Bachelor's Degree	153	261.54		
	Graduate Degree	51	266.83		

Examining Table 6, while no significant difference was found in the general engagement scores and the Performance dimension within the context of education level; statistically significant differences were detected in the Skills ($X^2 = 9.24$, $p = 0.026$), Emotion ($X^2 = 11.37$, $p = 0.010$), and particularly the Participation ($X^2 = 49.38$, $p < 0.001$) dimensions. The results of the Dunn's multiple comparison test revealed that participants with a graduate degree had significantly higher scores in the Skills and Emotion dimensions compared to high school graduates. The exact opposite situation was observed in the Participation dimension, which involves peer interaction and forum participation. While associate degree graduates demonstrated the highest social participation among the groups, it was determined that helping behaviors decreased as the education level rose toward the bachelor's and graduate levels.

B. Qualitative Results

To deeply interpret the findings obtained from the 521 individuals who participated in the survey during the quantitative phase of the research, the data of a subgroup ($n = 131$) who provided valid and detailed responses to the open-ended questions were analyzed using a deductive thematic analysis method. Qualitative findings were coded under four main themes: skills, emotion, participation, and performance, and were reported by integrating them with the quantitative findings. Students' experiences were grouped under the sub-themes of (a) independent study strategies (Skills), (b) professional integration and functionality (Emotion), (c) preferred social isolation (Participation), and (d) certificate-orientedness (Performance).

1) Skills dimension: Individual strategies

According to the results of the Dunn test applied in quantitative analyses, it was found that the 40–49 age group scored statistically higher than the 30–39 age group, and graduate degree holders scored higher than high school graduates in the Skills dimension. When qualitative data are examined, it is observed that the fundamental reason underlying this difference is the robust 'self-regulation' strategies developed by individuals in older age and higher education groups. The systematic tracking of course materials by older students was demonstrated by the following quotes:

"I definitely try to watch the lecture videos if there are any. While watching the videos, I take my own notes. I also make sure to read the written resources, especially the summary files." (P-51, Age 40–49, Graduate Degree)

"Proceeding with a plan is a must. The moment the course documents are uploaded to the system, I download them to my computer, highlight the important parts, and integrate them into my own professional archive." P-104, Age 40–49, Bachelor's Degree)

"Due to my age, rather than reading from a screen, I print out the materials and create physical folders. Every evening after dinner, I dedicate exactly one hour to these readings." (P-37, Age 50–59, Graduate Degree)

On the other hand, the responses of participants who struggled to balance their work and educational lives together and had lower skill scores point to obstacles concerning time management and focus:

"Because I work, I cannot follow up very regularly; I can only glance at the materials right before the exam."

(P-84, Age 30–39, High School)

“Since I work in shifts, I cannot allocate specific time for the classes. I usually try to watch the videos on my phone while commuting to work on the bus, but that is not very productive either.” (P-115, Age 30–39, Associate Degree)

2) Emotion dimension: Functionality

In further analyses using Dunn’s test, the significantly higher scores of adult learners in the 40–49 age range and graduate degree holders in the Emotion dimension compared to the 30–39 age group and high school graduates, respectively, directly converged with the theme of ‘functionality and professional belonging’ in the qualitative data. Adult students explained their emotional belonging to the program through their ability to directly integrate the content into their current professional lives:

“As a business owner, I believe occupational health and safety is a subject that must be known by every business owner, and this knowledge needs to be continuously updated. Therefore, I feel a complete sense of belonging to the program.” (P-77, Age 40–49, Graduate Degree)

“I can personally apply the legislation or rules I learn here the very next day at the office, which makes the education I receive very meaningful to me.” (P-18, Age 50–59, Bachelor’s Degree)

“The content of the program is geared exactly towards solving the problems we encounter in the field. Because it doesn’t remain purely theoretical, I feel like a part of this professional community.” (P-27, Age 40–49, Graduate Degree)

Conversely, younger participants at the very beginning of their careers defined their emotional engagement through the desire for it to be ‘useful in the future’ rather than its ‘current functionality’:

“It has nothing to do with my current job, but I feel completely like I belong because I think it will help me find a good job in the future.” (P-5, Age 18–29, Associate Degree)

“I see this training merely as a stepping stone on my CV, so I cannot say I have established an emotional connection.” (P-14, Age 18–29, Bachelor’s Degree)

3) Participation dimension: Social isolation

A significant finding emerging in the quantitative phase of the research was the very low overall average of the Participation (interaction/collaboration) dimension ($M = 2.14$). Furthermore, according to Dunn’s test results, while associate degree graduates exhibited the highest social participation, helping behaviors decreased as the education level increased.

Qualitative findings proved that this situation represents a ‘preferred social isolation’ from the perspective of highly educated lifelong learners. Students corroborated that they did not view forum discussions as an academic necessity through the following statements:

“I solely focused on myself. The educational materials already helped my learning. Group works or forums feel like a waste of time to me; progressing at my own pace is the best.” (P-15, Age 30–39, Graduate Degree)

“Because I am not very fond of people, studying individually suits me very well. I do not participate in online chats.” (P-4, Age 40–49, Bachelor’s Degree)

“The discussions in the forum mostly remain very superficial. Instead of reading others’ opinions, I prefer to read articles and do research directly. I only log into the forum if it is graded.” (P-40, Age 40–49, Graduate Degree)

Associate degree students, who expressed a greater need for peer support and collaboration on the platforms during the learning process, conveyed the situation as follows:

“It has a positive effect; hearing the parts I don’t understand from others helps me consolidate the topic.” (P-42, Age 18–29, Associate Degree)

“Thanks to the questions asked by others, I realize my own deficiencies that hadn’t occurred to me.” (P-88, Age 18–29, Associate Degree)

“The student WhatsApp groups we formed among ourselves have been my biggest motivation in this program; we are constantly helping each other out there.” (P-110, Age 18–29, Associate Degree)

The obtained findings indicate that as students’ academic autonomy increases, their need for social presence in online education decreases.

4) Performance dimension: Certificate-orientedness

Performance ($M = 2.94$), the engagement dimension that did not exhibit significant differences according to demographic variables including gender and prior distance education experience in quantitative analyses, also emerged as a shared theme among participants in qualitative data, irrespective of their characteristics. Students perceive the concept of success not merely as acquiring a document but also demand the professional competency that the document represents. The motivation of the students was revealed by the following quotes:

“I wanted to adequately grasp the topic of the course and acquire certificate competency. The two are an integral whole.” (P-1, Age 50–59, High School)

“My goal is not just to get a piece of paper, but to learn the qualified knowledge that backs up that paper. The two complement each other.” (P-92, Age 40–49, Associate Degree)

“The name on the certificate opens the door to a job interview for you, but the actual knowledge you learn there is what makes you permanent in that job. That is why both are very important to me.” (P-334, Age 30–39, Graduate Degree)

Additionally, students who emphasized the official validity of the certificate on digital platforms as an extrinsic motivation expressed their motivations as follows:

“Both are important; because without a certificate, I cannot prove to anyone that I have competency in this subject. Therefore, having the certificate appear on E-Government System is very important to me.” (P-5, Age 18–29, Bachelor’s Degree)

“No matter how well I learn, unless I document it, my employer will not give me the promotion I want.” (P-210, Age 40–49, High School)

C. Discussion

In this study, the engagement levels of students participating in online certificate programs within the scope of lifelong learning, and the individual and social factors affecting this engagement, were investigated using an

explanatory sequential mixed-methods design. The integration of the quantitative and qualitative findings of the research revealed that online student engagement is not a unidimensional concept; rather, it is a construct shaped by students' age, education level, and academic autonomy. The findings obtained within the scope of the study are discussed in light of the relevant literature, highlighting both supporting and contradictory aspects.

The findings of the research revealed that the general online engagement levels of the students were moderate. When the sub-dimensions were examined, it was observed that while students exhibited a relatively high motivation in the Skills and Emotion dimensions, they obtained considerably lower scores in the Participation dimension, which encompasses peer interaction and forum discussions. These findings align with the multi-dimensional structure of student engagement, delineated behaviorally, cognitively, and affectively, as emphasized by Fang *et al.* [43] and Heilporn *et al.* [15].

On the other hand, this contradicts the assumption held by researchers such as Kim *et al.* [56] and Ojo *et al.* [42], who posit that high social interaction and peer participation are indispensable prerequisites for successful online learning. The findings obtained in this research particularly expose the negative and limiting aspect of this situation: for lifelong learners, low social participation does not always equate to low cognitive or emotional engagement. This contradiction has been demonstrated within the context of the Community of Inquiry (CoI) model developed by Garrison *et al.* [79] and Bosch *et al.* [62]. It proves that students' deepening into the content through their own strategies achieves cognitive presence through individual efforts, but, as Lowenthal and Dunlap [80] forewarned, the sense of social presence cannot be artificially constructed via mandatory interaction tools like forums.

Findings related to the age variable revealed that adults in the 40–49 age group demonstrated statistically higher engagement in the Skills and Emotion dimensions compared to the 30–39 age group. The fact that middle-aged participants follow materials with a consistent self-regulation routine corroborates the finding emphasized in the literature by Donggil and Kim [68] and Mahama *et al.* [70] that self-directed learning capacities increase with age. Overlapping with Knowles' [40] theory of Andragogy, this situation proves that adults show high motivation to the extent that they can immediately apply the acquired knowledge to solve problems in their daily lives.

The emphasis on time management and shift-work difficulties by another age cohort, the 30–39 age group, contrasts with the promises of equitable access created by distance education in the literature [27, 28]. The obtained findings indicate that flexibility of time and space alone is insufficient, and that for young adults lacking high self-regulation skills [71] or overwhelmed by heavy workloads, online education can turn into a time management crisis. In this respect, the study critically demonstrates that lifelong learning policies do not offer the same equal opportunities to every age group.

When students are examined in terms of their education levels, the frequency of helping and participating in forums decreases statistically significantly as one progresses from

high school to graduate level. In light of the qualitative data, highly educated lifelong learners evaluated this situation not as a detachment or failure, but conversely as a preferred social isolation aimed at progressing at their own pace. This evaluation by the students aligns with the Transactional Distance theory updated by Moore [41]. Supporting the fundamental premise of the theory, since graduate degree holders possess high learner autonomy [39], they perceive independent learning not as isolation but as a productive study strategy. However, this situation points to a significant challenge for instructional designers. The assumption in the literature that standardized interaction tools, such as mandatory asynchronous forum participations, are beneficial for everyone [36], is clearly perceived as a waste of time by groups with high academic autonomy and alienates the student from the system. On the other hand, associate degree students seeking peer support in out-of-school chat environments demonstrates how much groups whose academic autonomy is in the developmental stage need the construction of an external social presence in digital ecosystems. This contradiction actually proves that a one-size-fits-all online course design is bound to fail.

In the research, it was determined that gender and prior distance education experience variables did not make a statistical difference on student engagement. The lack of an advantage provided by past experience contradicts the expectation in the literature that experienced students are more successful in online environments [87–89]. This is thought to be tied particularly to the mandatory use of online learning tools by all demographic groups following the COVID-19 pandemic [47] and the resulting similarities in the digital literacy levels of the student cohort.

Finally, the qualitative findings indicated that students perceived the concept of success in the certificate program as an integrated whole, acting as both an intrinsic motivational source, such as gaining professional competency, and an extrinsic one, such as acquiring an official officially recognized credential. Contrary to the traditional motivational approach often criticized in the literature, which argues that extrinsic rewards like certificates undermine intrinsic motivation; this research proves, within the framework of Self-Determination Theory [37, 38], that extrinsic motivation is internalized by lifelong learners and transformed into a professional goal. The convergence of students on the need for result-oriented certification, regardless of their education level or age, strongly emphasizes the socio-economic and survival function of lifelong learning in today's competitive labor market, as pointed out by Afzal and Crawford [13].

V. CONCLUSION

This study re-establishes the multi-dimensional and autonomy-driven nature of student engagement, challenging the prevailing notion in online learning literature that high interaction invariably yields high quality. The findings demonstrate that for adult learners with high academic autonomy, eschewing social interaction is not a manifestation of alienation; rather, it is a preferred social isolation strategy centered on efficiency. In this context, standardized interaction tools imposed across all educational levels such as mandatory participation in discussion groups cease to

function as pedagogical scaffolds and instead become counterproductive hurdles for advanced learners.

Furthermore, the research reveals that for young adults (ages 30–39) who lack strong self-regulation skills and are overwhelmed by heavy workloads, the flexibility afforded by the program can inadvertently devolve into a structural disadvantage. Finally, the study indicates that the expectation of certification should not be dismissed merely as a superficial source of extrinsic motivation; rather, it merges with the intrinsic desire for competence, elevating its significance within today's highly competitive professional landscape.

Regarding future studies, instructional designers must abandon one-size-fits-all interaction impositions when designing e-learning environments. In online certificate programs, instead of interaction tools being a mandatory evaluation criterion, they should be offered in a flexible participation structure that students can choose according to their academic autonomy levels. Thus, learners will interact with peers or the instructor when they truly need to, rather than out of obligation.

The emotional engagement of adult learners in online environments is directly tied to the functionality of the content. In this context, instead of classical, rote-learning based multiple-choice exams, case-study evaluation models where participants can solve problems they encounter in their own professional lives and integrate their occupational experiences into the process should be centered.

For associate degree and undergraduate students whose academic autonomy is still in the developmental phase, unofficial support systems such as university-supervised peer chat groups and asynchronous mentorship forums, which will eliminate the feeling of loneliness in digital learning environments, need to be encouraged and guided by the formal system.

In terms of future research, the impact of the concept of preferred social isolation on students' ultimate academic achievements, namely their grade point averages and program completion rates, should be investigated. As another research recommendation, experimental studies should examine the effectiveness of AI-supported adaptive micro-learning designs aimed at overcoming the time management problems of working adults aged 30–39.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

B.K.K: Conceptualization, research design, data collection, and original draft preparation. İ.K.: System development, methodology guidance, data analysis, manuscript editing, supervision and final review. All authors have read and agreed to the published version of the manuscript.

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