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ICT self-efficacy, ICT engagement and teaching enjoyment among Iranian EFL teachers: an age-moderated model

R. Nejati

English Department, Faculty of Humanities, Shahid Rajaee Teacher Training University, Tehran, Iran

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* Corresponding author
reza.nejati@sru.ac.ir
(+9821) 22970035

ABSTRACT

Background and Objectives: The integration of information and communication technologies (ICTs) into English as a foreign language (EFL) instruction is now a routine aspect of educational practice. It may be related to teachers' motivation, emotional experiences, and professional well-being. Previous research has mainly focused on issues such as technology adoption, technical skills and attitudes toward ICT. Much less attention has been paid to the emotional consequences of technology use. In particular, positive emotions such as teaching enjoyment remain underexplored. Age may be especially relevant in this respect. The present study examined the relationships among ICT self-efficacy, ICT engagement, and teaching enjoyment among Iranian high school EFL teachers. The study tested whether ICT engagement mediates the relationship between ICT self-efficacy and teaching enjoyment. It also investigated whether age moderates both the direct and indirect associations among these variables.

Materials and Methods: A cross-sectional correlational design was employed. Participants comprised 194 Iranian high school EFL teachers recruited through purposive sampling via social networking platforms. Participation was voluntary and anonymous. Teachers completed three self-report questionnaires assessing ICT self-efficacy, ICT engagement, and foreign language teaching enjoyment. All instruments were administered in Persian following a rigorous translation, back-translation, and content validation procedure. Teaching enjoyment was measured using a scale capturing personal enjoyment, student-related enjoyment, and collegial enjoyment. ICT engagement assessed teachers' behavioral, cognitive, motivational, and social involvement with digital technologies. ICT self-efficacy measured teachers' perceived capability to use ICT for instructional, professional, and communicative purposes. Age was operationalized as a categorical variable. Before analysis, data were screened for normality, multicollinearity, and suitability for parametric procedures. Structural equation modeling and regression-based analyses were conducted to test mediation, moderation, and moderated mediation associations. Indirect associations were evaluated using bootstrapped confidence intervals to ensure robust estimation of conditional relationships.

Findings: The results indicated that ICT self-efficacy was positively associated with both ICT engagement and teaching enjoyment. ICT engagement was also positively associated with teaching ICT self-efficacy and teaching enjoyment. Age significantly moderated the relationship between ICT engagement and teaching enjoyment. Among younger teachers, higher levels of ICT engagement were associated with greater teaching enjoyment. Among older teachers, this relationship was weak and not statistically significant. ICT self-efficacy was negatively related to ICT engagement among older teachers. Moderated mediation analyses further showed that ICT engagement mediated the relationship between ICT self-efficacy and teaching enjoyment only among younger teachers. For older teachers, the indirect association did not reach statistical significance. After accounting for engagement, the relationship between ICT self-efficacy and teaching enjoyment is partially moderated by age.

Conclusions: These findings suggest that ICT engagement plays a crucial role in translating teachers' ICT self-efficacy into teaching enjoyment, but this process is partially moderated by age. For younger teachers, engagement with technology appears to be an emotionally meaningful activity through which confidence in ICT use is associated with teaching enjoyment. For older teachers, ICT use may be more selective or instrumental, carrying less

affective significance. The results underscore the importance of adopting an age-sensitive perspective in professional development and technology integration policies. Teaching enjoyment is associated with more than improving technical skills. It is also associated with meaningful, autonomy-supportive forms of ICT engagement that align with teachers' pedagogical values and professional identities. Limitations include reliance on self-report measures, non-probability sampling and a cross-sectional design that precludes causal inference. Future research would benefit from longitudinal designs to explore how technology-related emotions are associated across teachers' age groups and how contextual factors shape these experiences in diverse educational settings.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
72	0	5

مقاله پژوهشی

خودکارآمدی فناوری، درگیری با فناوری و لذت تدریس در میان معلمان زبان انگلیسی ایران: مدلی با نقش تعدیل‌گری سن

رضا نجاتی

گروه زبان انگلیسی، دانشکده علوم انسانی، دانشگاه تربیت دبیر شهید رجائی، تهران، ایران

چکیده

پیشینه و اهداف: ادغام فناوری‌های اطلاعاتی و ارتباطی در آموزش زبان انگلیسی به‌عنوان زبان خارجی امروزه به بخشی عادی از شیوه‌های آموزشی تبدیل شده است. این ادغام می‌تواند باانگیزه معلمان، تجربه‌های هیجانی و آسایش شغلی آنان مرتبط باشد. پژوهش‌های پیشین عمدتاً بر موضوعاتی مانند پذیرش فناوری، مهارت‌های فنی و نگرش نسبت به فناوری آموزش تمرکز داشته‌اند، درحالی‌که به پیامدهای هیجانی استفاده از فناوری توجه بسیار کمتری شده است. به‌ویژه، هیجان‌های مثبت مانند لذت تدریس کمتر مورد بررسی قرار گرفته‌اند. سن معلم در این زمینه می‌تواند اهمیت بسزایی داشته باشد. پژوهش حاضر روابط میان «خودکارآمدی فناوری»، «درگیری با فناوری» و لذت تدریس را در میان دبیران زبان انگلیسی دبیرستان‌ها در ایران بررسی کرد. این مطالعه نقش «درگیری با فناوری» را به‌عنوان میانجی بین رابطه «خودکارآمدی فناوری»؛ و لذت تدریس و نقش سن را به‌عنوان متغیر تعدیل در رابطه سه متغیر مذکور بررسی کرده است.

روش‌ها: در این پژوهش از طرح همبستگی استفاده شد. شرکت‌کنندگان شامل ۱۹۴ دبیر زبان انگلیسی دبیرستان‌های ایران بودند که از طریق نمونه‌گیری هدفمند و با استفاده از سکوهای شبکه‌های اجتماعی جذب شدند. مشارکت داوطلبانه و ناشناس بود. معلمان سه پرسش‌نامه خوداظهاری را برای سنجش «خودکارآمدی فناوری»، «درگیری با فناوری» و لذت تدریس زبان خارجی تکمیل کردند. همه ابزارها پس از اجرای دقیق فرایند ترجمه، بازترجمه و اعتبارسنجی محتوایی به زبان فارسی اجرا شدند. لذت تدریس با مقیاسی سنجیده شد که لذت شخصی، لذت مرتبط با دانش‌آموز و لذت تعامل با همکاران را در بر می‌گرفت. «درگیری با فناوری» میزان مشارکت رفتاری، شناختی، انگیزشی و اجتماعی معلمان با فناوری‌های دیجیتال را ارزیابی می‌کرد. «خودکارآمدی فناوری» نیز توان ادراک‌شده معلمان برای استفاده آموزشی، حرفه‌ای و ارتباطی از فناوری را می‌سنجید. سن به‌صورت متغیر مقوله‌ای عملیاتی شد. پیش از تحلیل، داده‌ها از نظر نرمال بودن، هم‌خطی چندگانه و مناسب‌بودن برای آزمون‌های پارامتریک بررسی شدند. برای آزمون روابط میانجی‌گری، تعدیل‌گری و «میانجی‌گری تعدیل‌شده» از مدل‌یابی معادلات ساختاری و تحلیل‌های مبتنی بر رگرسیون استفاده شد.

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* نویسنده مسئول
Reza.nejati@sru.ac.ir
۰۲۱-۲۲۹۷۰۰۳۵

روابط غیرمستقیم با بهره‌گیری از فاصله‌های اطمینان «بوت‌استرپ» ارزیابی شدند تا برآوردی دقیق از روابط شرطی حاصل شود.

یافته‌ها: نتایج نشان داد که «خودکارآمدی فناوری» با هر دو متغیر «درگیری با فناوری» و لذت تدریس رابطه مثبت دارد. «درگیری با فناوری» نیز با «خودکارآمدی فناوری» و لذت تدریس رابطه مثبت نشان داد. سن معلمان رابطه میان «درگیری با فناوری» و لذت تدریس را به طور معنادار تعدیل کرد. در میان معلمان جوان‌تر، سطوح بالاتر «درگیری با فناوری» با لذت تدریس بیشتر همراه بود؛ اما در میان معلمان مسن‌تر، این رابطه ضعیف و از نظر آماری معنادار نبود. «خودکارآمدی فناوری» در میان معلمان مسن‌تر با «درگیری با فناوری» رابطه منفی داشت. تحلیل‌های میانجی‌گری تعدیل‌شده همچنین نشان داد که تنها در میان معلمان جوان‌تر «درگیری با فناوری» در رابطه بین «خودکارآمدی فناوری» و لذت تدریس نقش میانجی دارد. برای معلمان مسن‌تر، رابطه غیرمستقیم به سطح معناداری آماری نرسید. پس از تثبیت سهم «درگیری با فناوری»، رابطه میان «خودکارآمدی فناوری» و لذت تدریس در حد بسیار کم توسط عامل سن تعدیل می‌شود.

نتیجه‌گیری: این یافته‌ها نشان می‌دهد که «درگیری با فناوری» نقش‌محوری در تبدیل «خودکارآمدی فناوری» معلمان به لذت تدریس ایفا می‌کند، اما این فرایند تا حدی توسط سن تعدیل می‌شود. به نظر می‌رسد برای معلمان جوان‌تر، «درگیری با فناوری» فعالیتی هیجانی باشد که از طریق آن، اعتماد به استفاده از فناوری با لذت تدریس پیوند می‌یابد. برای معلمان مسن‌تر، استفاده از فناوری ممکن است گزینشی‌تر یا ابزاری‌تر باشد و بار عاطفی کمتری داشته باشد. نتایج بر اهمیت اتخاذ رویکردی حساس به سن در برنامه‌های تربیت‌معلم و سیاست‌های ادغام فناوری تأکید می‌کند. لذت تدریس صرفاً به بهبود مهارت‌های فنی محدود نمی‌شود؛ بلکه به‌صورت معنادار و حمایت‌کننده و اختیاری با «درگیری با فناوری» نیز مرتبط است که با ارزش‌های آموزشی و هویت‌های حرفه‌ای معلمان هم‌راستا باشند. محدودیت‌های پژوهش شامل اتکا به ابزارهای خوداظهاری، نمونه‌گیری غیرتصادفی و طرح مقطعی است که استنباط علّی را غیرممکن می‌کند. پژوهش‌های آینده می‌توانند با طرح‌های طولی هیجان‌های مرتبط با فناوری در گروه‌های سنی مختلف معلمان را بررسی و عوامل زمینه‌ای این تجربه‌ها را در محیط‌های آموزشی متنوع کشف کنند.

Introduction

The expansion of information and communication technologies (ICTs) in EFL contexts has altered how English is taught, extending its impact beyond instructional techniques. Research suggests that ICT adoption also bears on teachers' motivational states, emotional responses, and psychological experiences [1,2]. While early research emphasized access to digital tools and technical skills, recent studies suggest that effective ICT integration depends more critically on teachers' engagement with technology, their self-efficacy beliefs, and affective outcomes such as teaching enjoyment [3–6]. These psychological factors are particularly important, as technology adoption alone does not guarantee instructional effectiveness or teacher well-being.

From the Uses and Gratifications Theory (UGT) perspective, teachers' engagement with ICT is driven by the intention to meet specific professional and instructional demands, such as supporting student learning, obtaining instructional materials, and facilitating classroom management tasks [7–9]. Moving beyond explanations centered solely on needs, the Technology Acceptance Model (TAM) highlights perceived usefulness and perceived ease of use as central determinants of teachers' continued involvement with technological tools [10,11]. However, TAM's rationalist focus may underrepresent motivational and affective processes, while UGT-based studies often remain descriptive, limiting insight into the psychological mechanisms that sustain engagement over time [12,13].

Closely related to ICT engagement is ICT self-efficacy, rooted in Bandura's [14] Social Cognitive Theory, which holds that teachers with higher ICT self-efficacy are more tending to adopt digital tools, implement innovative instructional practices, and persist when facing

technological challenges [15,16]. From a Self-Determination Theory (SDT) perspective, perceived competence supports intrinsic motivation and autonomy, thereby fostering engagement and well-being [17–19].

Teaching enjoyment has emerged as a theoretically important affective dimension of teachers' engagement with ICT, particularly in EFL contexts [20,21]. Teaching enjoyment refers to a positive and enduring emotional state associated with satisfaction and engagement in instructional activities [22–24]. According to Flow Theory, teachers experience enjoyment when the challenges they face in instruction are well matched to their perceived skills, leading to intense involvement and intrinsic satisfaction [25–27]. From the perspective of Broaden-and-Build Theory, enjoyment functions as a resource-generating emotion that broadens teachers' cognitive and behavioral capacities, promoting upward spirals of engagement and strengthening self-efficacy [28,29]. However, empirical models that integrate ICT engagement, self-efficacy, and teaching enjoyment—particularly in EFL settings—remain limited [30].

Individual differences, notably age, may moderate these relationships. Research indicates that older teachers often report lower levels of ICT self-efficacy, potentially reflecting differential exposure, variations in digital fluency, or stronger reliance on established instructional routines [31,32]. From a lifespan perspective, age may influence how teachers render ICT engagement and efficacy beliefs into affective experiences, such as enjoyment. Yet age is rarely modeled as a moderator in these psychological pathways, leaving important developmental and contextual dynamics insufficiently understood [33].

Review of the Related Literature

ICT self-efficacy refers to teachers' beliefs in their ability to use digital tools effectively for instructional purposes [14,15,33]. These beliefs influence how teachers approach new technologies, respond to challenges, and integrate ICT into classroom routines. Self-efficacy is partly technical and partly pedagogical; however, dominant frameworks often foreground operational skills (e.g., navigating software, troubleshooting) over relational or instructional uses of technology, reflecting what scholars describe as techno-rationalist framings of teacher competence [34].

Older teachers often report lower ICT self-efficacy than younger colleagues, a pattern frequently attributed to later exposure to digital technologies and professional socialization in pre-digital instructional contexts [35,36]. For many, ICT competence developed reactively in response to institutional mandates rather than through exploratory or self-initiated use, which may influence how technology is integrated into established pedagogical routines [32].

Iranian EFL research similarly indicates that younger teachers tend to report higher confidence and greater engagement with multimedia tools and digital platforms than older colleagues [37]. These differences appear to reflect variations in professional socialization rather than simple skill deficits.

Importantly, lower ICT self-efficacy does not necessarily indicate lower technical skill. Rather, efficacy beliefs are shaped by professional identity and accumulated pedagogical experience, which may influence how digital practices are emotionally appraised, particularly among older teachers [14,2].

ICT engagement is generally viewed as a multidimensional construct that encompasses teachers' behavioral, cognitive, and emotional involvement with technology [38]. It refers not only to how often teachers use digital tools, but also to the depth and meaningfulness of their interactions with them [39]. ICT engagement involves activities such as exploring and experimenting with digital resources, thereby sustaining their use over time, and integrating them purposefully into pedagogical practice.

Age moderates ICT engagement partly because teachers' motivational dispositions, professional priorities and identity concerns evolve across the life span [40,41]. Younger teachers often approach technology with curiosity, ambition and identity-building motives. As such, ICT competence is viewed as an indicator of modern pedagogy and professional legitimacy within contemporary educational contexts [42,30]. For many young teachers, digital proficiency is closely tied to aspirations for innovation and recognition [43].

As teachers accumulate experience, ICT engagement tends to become more selective and pragmatic. Mid-career teachers, who frequently balance intensified teaching demands alongside administrative responsibilities and family commitments, are more likely to evaluate technology use in terms of cost–benefit considerations, asking whether the effort invested yields tangible pedagogical returns [41,44]. In later career stages, teachers often rely on instructional approaches that have demonstrated effectiveness over time, which can lead to more cautious or skeptical orientations toward ICT adoption, particularly when new technologies are perceived as disruptive to established practices rather than supportive of them [45].

Iran's educational system has experienced some technology reforms, often structured through centralized, top-down policy initiatives that seek to modernize teaching and learning (e.g., adoption of national educational ICT platforms and infrastructure programs) but whose implementation varies widely across regions (e.g., connectivity, access to devices) [46,47].

Teaching enjoyment is a positive emotional experience that emerges when teachers feel effective, connected, and productive [48,49]. Enjoyment matters because it supports persistence, creativity and pedagogical risk-taking. Research shows that technology can increase enjoyment by diversifying instructional materials, enabling interactive tasks and enhancing communication [50]. However, ICT can also erode enjoyment when it introduces technical problems, cognitive overload, or unfamiliar routines—particularly for teachers with lower ICT self-efficacy.

Teachers' emotional reactions to technology can be effectively explored by integrating insights from both Self-Determination Theory (SDT) and the Technology Acceptance Model (TAM). SDT posits that positive feelings and intrinsic motivation toward professional activities emerge when individuals experience autonomy, competence, and relatedness [18]. In technology-rich teaching settings, these needs are more likely to be satisfied when teachers feel capable of using ICT, perceive choice in its implementation, and maintain meaningful interactions with students and colleagues [2]. TAM emphasizes that perceived usefulness and ease of use shape attitudes toward technology and intentions to adopt it [10,11]. Empirical research suggests that age and teaching experience may relate to teachers' attitudes towards ICT use, although these relationships are typically modest and highly context-dependent rather than uniformly linear [51]. In addition to age, alignment between technological tools and teachers' pedagogical values, instructional goals, and classroom

interaction patterns appears central to fostering positive emotional engagement. Mohammadi & Yousofi [52] highlight the importance of relational, narrative and culturally mediated pedagogical practices in shaping teachers' affective experience.

The literature consistently links ICT self-efficacy to teachers' engagement with digital technologies, which in turn shapes their enjoyment of teaching. This association, however, is indirect and varies with age. Conceptualizing ICT engagement as a mediating variable between self-efficacy and teaching enjoyment, with age as a moderator, provides a lens for understanding why digitalization produces uneven emotional outcomes among Iranian EFL teachers.

From a Social Cognitive and Self-Determination perspective, ICT self-efficacy reflects perceived competence as a core driver of autonomous engagement [14,18]. Teachers who are competent in using ICT tend to explore and integrate digital tools. Nevertheless, self-efficacy alone does not guarantee enjoyment. Positive affect arises when engagement is meaningful, pedagogically aligned, and voluntary. Imposed tasks may reduce enjoyment even among competent users.

The Flow Theory clarifies this mediating role: enjoyment emerges when ICT challenges match teachers' skills [53]. Younger teachers, familiar with digital routines, more readily experience flow, reinforcing both engagement and self-efficacy. Older teachers often encounter a mismatch between task demands and established teaching schemas, which may trigger anxiety and weaken the self-efficacy–enjoyment link.

Research on teacher technology adoption suggests that positive ICT experiences can broaden educators' thought-action repertoires—expanding their cognitive flexibility and behavioral options for classroom innovation—while repeated negative experiences (such as system instability or coercive implementation) may narrow engagement and diminish perceived competence, particularly among older teachers who face steeper learning curves [29,33].

These patterns align with Fredrickson's Broaden-and-Build Theory, which postulates that positive emotions broaden momentary thought-action repertoires and build enduring personal resources over time, whereas negative emotions narrow attention and behavioral options. While originally developed in positive psychology, this framework has been applied to technology contexts to explain how emotional responses to ICT shape long-term engagement trajectories.

TAM identifies perceived usefulness and perceived ease of use as major factors of technology adoption [10]. Empirical studies applying TAM to educational contexts have found that age-related differences in these perceptions are often mediated by prior experience rather than age itself and can influence adoption decisions among teachers [11]. Notably, self-efficacy is not a construct in the original TAM but appears in extended models (e.g., TAM2) and related frameworks like the Unified Theory of Acceptance and Use of Technology (UTAUT).

The Uses and Gratifications Theory offers a complementary lens by examining how teachers actively select technologies to satisfy specific professional needs (e.g., efficiency, student engagement), rather than passively responding to system features [8]. This theory does not address ease of use or self-efficacy but helps explain why educators pursue particular technologies based on anticipated gratifications.

The Broaden-and-Build Theory highlights how experiences with ICT build over time. Positive experiences can expand teachers’

thinking and actions, encouraging creativity and more engagement. On the other hand, early negative experiences such as unstable systems or top-down mandates can lower engagement and reduce feelings of competence, especially for older teachers. The Uses and Gratifications Theory and the Technology Acceptance Model add that age can shape how teachers see the usefulness and ease of digital tools. These perceptions, in turn, affect how self-efficacy leads to engagement and teaching enjoyment.

In Iranian EFL contexts, where teaching is deeply relational and professional authority is tied to experience, ICT self- efficacy does not automatically yield teaching enjoyment; rather, its emotional payoff depends on whether ICT engagement aligns with teachers' autonomy, competence, and pedagogical values [54]. Phenomenological evidence also shows that teacher enjoyment connects with perceptions of control and efficacy in instructional roles [52]. When engagement satisfies these personal and contextual needs, teachers experience more positive emotions, but when it conflicts with established pedagogical identities or relational values, enjoyment may diminish or even turn into frustration. Empirical evidence from Iranian EFL research supports mediated paths wherein engagement explains part of the link between competence-related constructs and work motivations or affect [55]. These patterns support a moderated mediation framework in which ICT engagement mediates the self- efficacy–enjoyment relationship and age (or experience level) moderates both the strength of engagement and its emotional outcome, helping explain why digitalization energizes some teachers while challenging others (e.g., age/experience differences in technology perception reported in teacher ICT attitude studies; see Clipa et al. [56]). The present study proposes the following questions.

- Does ICT engagement mediate the relationship between ICT self-efficacy and teaching enjoyment?
- Does age moderate the relationship between ICT self-efficacy and ICT engagement?
- Does age moderate the indirect relationship between ICT self-efficacy and teaching enjoyment through ICT engagement?

Method

Participants

The study focused on Iranian high school EFL teachers. Because there is no complete national registry of teachers and the population is geographically dispersed, participants were recruited through a mix of purposive and snowball sampling. Initial invitations were shared on popular social media platforms such as Telegram, WhatsApp, and Eitaa. Each recipient was encouraged to share the survey link with colleagues, facilitating a chain-referral recruitment process that has been shown to be effective for accessing dispersed professional communities [57].

A total of 194 teachers took part in the study. While non-probability sampling limits the generalizability of the findings, it remains a practical and accepted strategy in educational research when random sampling is unfeasible [58]. Screening analyses confirmed that the data were appropriate for parametric procedures: distributions showed acceptable skewness and kurtosis, linearity was evident in scatterplots, and variance inflation factors (VIFs) were below 5 [59]. Sample size guidelines for mediation and SEM analyses generally suggest a minimum of 200–250 participants [60]; accordingly, the present sample size can be considered adequate for examining the proposed associations and indirect pathways. Nevertheless, the use of digital platforms for recruitment may have favored teachers with

higher levels of technological competence, which could be reflected in relatively high levels of ICT engagement and teaching enjoyment in the sample.

Instruments

Data were collected using three questionnaires, namely, Foreign Language Teaching Enjoyment (FLTE), ICT Engagement, and ICT Self-Efficacy.

Teachers' language teaching enjoyment was quantified using the 10-item FLTE scale adapted from Dewaele and Li [55]. This instrument is grounded in positive psychology principles [61]. It assesses enjoyment across three dimensions, namely personal (Items 1, 4, 7, 10), student-centered (Items 2, 5, 8), and collegial enjoyment (Items 3, 6, 9). Responses were rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Reliability for the Persian adaptation was satisfactory (α = .88), consistent with prior reports (α = .85–.89; [55,62]).

The 21-item ICT Engagement Scale [1] measured teachers' attitudes, motivations, and behavioral patterns regarding technology use. The scale includes four subscales, namely interest in ICT (Items 1–6), perceived competence (Items 7–11), autonomy in ICT use (Items 12–17), and ICT as a social topic (Items 18–21). Participants indicated how frequently they engaged with each activity on a 5-point scale (1 = never, 5 = every day). Reliability of this questionnaire in the present sample was strong (α = .91) and comparable to values reported in previous studies (α = .76–.89; [1,63,64]).

Teachers' efficacy in using ICT was assessed with an 18-item scale developed by Compeau and Higgins [15], which evaluates self-efficacy across four domains, namely basic ICT operations and troubleshooting (Items 1–5), instructional use (Items 6–9), support for student-centered learning (Items 10–14), and professional communication (Items 15–18). Items were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Reliability in this sample was excellent (α = .95), consistent with prior research [65–66].

Age was operationalized as a categorical variable measured in self-reported years. Following recommendations in educational technology and organizational psychology research, age was modeled as a moderator through interaction terms with ICT engagement and ICT self-efficacy to test developmental and cohort-based differences in teaching enjoyment [67,68,69]. To examine the robustness of findings, supplementary analyses recoded age into two categories (20–40, ≥ 41 years), consistent with prior work on generational differences in technology use in educational contexts [70].

Procedure

All instruments were translated into Persian using a multi-step translation procedure. Two bilingual EFL instructors independently produced initial translations, which were subsequently synthesized by a third instructor. A panel of three experts evaluated the translations for semantic, conceptual, and cultural fidelity. After finalizing the items, they were combined into a single Google Form. All items were obligatory to prevent missing responses [71].

The questionnaires were distributed via Telegram, WhatsApp, and Eitaa. Participation was voluntary, and respondents were free to withdraw at any stage. At the beginning, participants reviewed an information sheet outlining the study's objectives, confidentiality and data protection procedures. Responses were automatically saved in a Google Drive folder, then exported to Excel for analysis. Ethical approval for the study was obtained from the author's institutional Research Ethics Committee (Ref: SRTTU-REC-2024-087).

Structural equation modeling (SEM) was employed to assess the validity of the measurements. Mediation analyses were used to test the indirect association between ICT self-efficacy and teaching enjoyment through ICT engagement, with bootstrapped confidence intervals used to estimate the indirect effect. Moderation analyses examined whether age was associated with variation in the modeled pathways and moderated mediation analyses assessed whether the indirect association between ICT self-efficacy and teaching enjoyment via ICT engagement differed across age groups. This method enabled the simultaneous examination of direct, indirect and conditional relationships among the variables, offering a rigorous evaluation of the study's conceptual framework [69].

Design

This paper adopted a quantitative, cross-sectional correlational design to examine the relationships among ICT self-efficacy, ICT engagement, and teaching enjoyment among Iranian EFL teachers, with age tested as a moderating variable. Data were collected through three self-administered online questionnaires.

Results and Findings

A total of 194 Iranian high school EFL teachers completed three questionnaires: an 18-item ICT self-efficacy scale, a 10-item instrument assessing Foreign Language Teaching Enjoyment, and a 21-item ICT engagement assessment. Data were analyzed using PROCESS 4 through descriptive statistics and mediation and moderation modeling.

The descriptive information for all measured constructs is displayed separately for younger teachers (20–40 years) and older teachers (≥ 41 years) in Table 1. Among younger teachers (n = 130), the mean teaching enjoyment score was 44.19 (SD = 6.33), the mean ICT engagement score was 85.98 (SD = 10.19), and the mean ICT self-efficacy score was 75.79 (SD = 12.92). Skewness and kurtosis values for these variables ranged from –1.35 to 1.12. These values suggest acceptable departures from normality for parametric analyses. For older teachers (n = 64), the mean enjoyment score was 44.06 (SD = 4.96), the mean ICT engagement score was 75.3 (SD = 15.46), and the mean ICT self-efficacy score was 67.41 (SD = 18.63).

Table 1: Descriptive Statistics

Variable	Age Group	n	Min	Max	Mean	SD	Skewness	Kurtosis
Enjoyment	20–40	130	28	50	44.19	6.33	–0.9·	–0.42
ICT engagement	20–40	130	59	105	85.68	10.19	–0.47	–0.23
ICT efficacy	20–40	130	33	90	75.79	12.92	–1.35	1.12
Enjoyment	41+	64	36	50	44.06	4.96	–0.23	–1.38
ICT engagement	41+	64	48	103	75.30	15.46	–0.05	–0.91
ICT efficacy	41+	64	25	90	67.41	18.63	–0.91	0.10

Skewness and kurtosis values were within conventional bounds (–1.38 to 0.10), indicating reasonably symmetric distributions. Younger teachers reported higher ICT engagement and lower self-efficacy than older teachers, whereas enjoyment scores were similar across age groups.

The measurement model was evaluated before examining the associations among constructs. As shown in Table 2, the three instruments exhibited satisfactory reliability and an acceptable factorial structure. Teaching Enjoyment demonstrated a high level of internal consistency (CR = 0.9۱) and satisfactory shared variance among its indicators (AVE = 0.51). Comparable patterns were observed for ICT Self-Efficacy, which yielded a composite reliability of 0.97 and an AVE of 0.66. ICT Engagement also showed strong convergent validity (AVE = 0.86), accompanied by an exceptionally high composite reliability coefficient (CR = 0.99). In general, reliability estimates for all constructs were above the threshold of 0.70. ICT engagement correlated moderately with Teaching Enjoyment (r = .31) and ICT Self-Efficacy (r = .67). These indices render the measurement model appropriate. Construct distinctiveness was examined using the Fornell–Larcker criterion. In each case, the square root of the AVE was larger than the corresponding correlations with other latent variables, all of which were below 0.72. These results indicate that the constructs were not unduly overlapping.

Notwithstanding these acceptable measurement properties, the composite reliability estimate for ICT engagement warrants careful consideration. Although high reliability coefficients are typically viewed as advantageous, values that approach unity may signal item overlap or an excessively restrictive representation of the construct. As noted by Hair et al. [72], composite reliability values exceeding .95 should be interpreted with caution, as they can indicate semantic redundancy rather than superior measurement accuracy. Accordingly, future research may benefit from further scale refinement, including the removal of overlapping items to achieve greater parsimony.

Age was coded as 1 = younger teachers and 2 = older teachers. In this coding scheme, the reported coefficient for Age reflects the difference in the outcome between older and younger teachers: positive values indicate higher scores for older teachers and negative values indicate lower scores. Interactions involving age indicate whether the association between a predictor (e.g., ICT engagement or ICT self-efficacy) and the outcome differs across the two age groups. Moderated regression analyses were then run to examine whether the associations among ICT self-efficacy, ICT engagement, and teaching enjoyment varied across age groups.

The first model examined teaching enjoyment as the outcome (Table 3). The model was statistically significant, $F(4, 189) = 14.09$, $p < .001$ and explained approximately 19% of the variance in enjoyment ($R^2 = .19$). ICT engagement was positively associated with enjoyment ($b = 0.07$, $SE = 0.03$, $p < .00$), as was ICT self-efficacy, although the latter association was smaller ($b = 0.46$, $SE = 0.10$, $p < .00$). Age was not associated with enjoyment ($b = 1.27$, $SE = 0.88$, $p < .15$).

Table 2: Measurement Model Validity Statistics (N = 194)

Construct	CR	AVE	√AVE	Correlations
Teaching Enjoyment	0.91	0.51	0.716	r = .31 (efficacy), .32 (engagement)
ICT Self-Efficacy	0.97	0.66	0.716	r = .31 (enjoyment), .67 (engagement)
ICT Engagement	0.99	0.86	0.774	r = .32 (enjoyment), .67 (efficacy)

Table 3: Moderated Regression Analysis Predicting Teaching Enjoyment

Predictor	*b*	SE	*t*	*p*	95% CI
ICT Self-Efficacy	0.07	0.03	2.16	.032	[0.01, 0.14]
ICT Engagement	0.46	0.10	4.68	0 .000	[0.26, 0.65]
AGE	1.27	0.88	1.44	0.15	[-0.47, 3.01]
ICT Engagement × AGE	−0.23	0.06	−4.07	0 .000	[−0.34, −0.12]

Model summary. $R = .43$, $R^2 = .19$, F (4, 189) = 14.09, $p < .001$.

Conditional associations of ICT engagement

AGE	*b*	SE	*t*	*p*	95% CI
Younger teachers	0.23	0.05	4.54	0 .000	[0.13, 0.33]
Older teachers	0.00	0.04	0.06	.95	[−0.08, 0.09]

Note. AGE is a dichotomous age grouping variable coded as 1 = younger teachers and 2 = older teachers. Coefficients represent unstandardized associations. Confidence intervals are based on 95% limits.

The interaction between ICT engagement and age was statistically significant (b = -0.23, SE = 0.06, p < .00). It amounts to saying that the association between ICT engagement and teaching enjoyment was moderated by age. Conditional association analyses indicated a positive association for younger teachers (b = 0.23, SE = 0.05, p < .001), but not significant for older teachers (b =- 0.00, SE = 0.04, p = .95). These findings suggest that higher ICT engagement tends to co-occur with greater teaching enjoyment primarily among younger teachers (Table 3).

The second model examined ICT engagement as the outcome (Table 4). The model was statistically significant, F (3, 190) = 56.46, p < .001, explaining approximately 50% of the variance ($R^2 = .50$). ICT self-efficacy was positively associated with ICT engagement (b = 0.38, SE = 0.14, p < .001). This indicates that higher perceived ICT capability tended to co-occur with higher engagement. Age group was negatively associated with ICT engagement, with older teachers reporting lower levels of engagement (b = −5.91, SE = 1.67, p < .001). The interaction between ICT self-efficacy and age group was not statistically significant (b = 0.09, SE = 0.09, p = .328). This suggests that the association between self-efficacy and engagement was not moderated by age groups.

To examine whether ICT engagement mediated the relationship between ICT self-efficacy and teaching enjoyment and whether this indirect pathway differed by age group, a moderated mediation analysis was conducted (Table 5). Results indicated a significant direct association between ICT self-efficacy and teaching enjoyment (b = 0.07, SE = 0.03, p = .032). This shows that teachers reporting greater confidence in their ICT capabilities also tended to report higher levels of teaching enjoyment irrespective of their actual ICT engagement.

Table 4: Moderated Regression Analysis Predicting ICT Engagement

Predictor	*b*	SE	*t*	*p*	95% CI
ICT Self-Efficacy	0.38	0.14	2.77	< .006	[0.11, 0.65]
AGE	−5.91	1.67	−3.54	< .001	[−9.02, −2.62]
ICT Self-Efficacy × AGE	0.09	0.09	0.98	.328	[−0.09, 0.28]
Model summary. R = .70, R^2 = .50, F (3, 190) = 56.46, p < .001.					

Note. AGE is a dichotomous age-group variable coded as 1 = younger teachers and 2 = older teachers. Coefficients are unstandardized and represent associations. CI = confidence interval.

ICT self-efficacy was also positively associated with ICT engagement, while age group was negatively associated with engagement. The interaction between self-efficacy and age group in predicting engagement was not significant, indicating that age did not moderate the self-efficacy–engagement association.

Despite this, the conditional indirect association between ICT self-efficacy and teaching enjoyment via ICT engagement differed by age group. Among younger teachers, ICT self-efficacy was positively associated with enjoyment through engagement (indirect effect = 0.11, BootSE = 0.02, 95% CI [0.08, 0.14]). In contrast, the indirect association among older teachers was small and not statistically significant (indirect association = 0.00, BootSE = 0.01, 95% CI [−0.02, 0.03]). The index of moderated mediation was statistically significant (index = −0.11, BootSE = 0.02, 95% CI [−0.14, −0.07]), indicating that the strength of the indirect association varied systematically across age groups (Table 5). These findings suggest that ICT engagement functions as a meaningful correlate linking ICT self-efficacy to teaching enjoyment primarily among younger teachers. However, this indirect pathway is absent among older teachers.

Discussion

The present study considered associations among ICT self-efficacy, ICT engagement, and teaching enjoyment in Iranian high school EFL teachers, with age as a moderating factor. The findings are interpreted in relation to teachers' engagement behaviors and career-stage differences.

Consistent with prior research [14,15,2], ICT self-efficacy was positively associated with teaching enjoyment, suggesting that the teachers' perceived digital competence tends to co-occur with more favorable affective experiences in professional contexts. From the perspective of Self-Determination Theory, having confidence in one's digital skills may support the fulfillment of the basic psychological need for competence, which is typically associated with intrinsic motivation and positive emotional experiences [18]. Teachers who perceive themselves as capable of using digital tools may therefore report greater autonomy and creative involvement in instructional tasks, alongside higher levels of teaching enjoyment.

Table 5: Direct and Conditional Indirect Associations Between ICT Self-Efficacy and Teaching Enjoyment

Direct Association					
Path	***b***	**SE**	***t***	***p***	**95% CI**
ICT Self-Efficacy → Enjoyment	0.07	0.03	2.16	.032	[0.01, 0.14]
Conditional Indirect Associations via ICT Engagement					
Age Group	Indirect Effect	BootSE	95% Boot CI		
Younger teachers	0.11	0.03	[0.06, 0.16]		
Older teachers	0.00	0.02	[−0.05, 0.05]		
Moderated Mediation					
Index		BootSE	95% Boot CI		
Index of moderated mediation (AGE)		−0.11	[−0.17, −0.04]		

Note. AGE is a dichotomous age-group variable coded as 1 = younger teachers and 2 = older teachers. Indirect effects are estimated using bootstrap confidence intervals (95%). Coefficients represent unstandardized associations and should not be interpreted causally.

Nevertheless, the association between ICT self-efficacy and teaching enjoyment was relatively modest when compared with the association involving ICT engagement, indicating that perceived competence alone may be insufficient to account for variation in emotional experiences. This pattern resonates with Flow Theory [26] and Broaden-and-Build Theory [29], both of which emphasize the role of sustained engagement, skill–challenge alignment, and positive affective cycles rather than competence perceptions in isolation. In this sense, teaching enjoyment appears to be more closely linked to teachers' ongoing meaningful engagement with digital tools than to confidence alone.

The findings suggest that ICT engagement functions as a relevant mediating variable in the association between ICT self-efficacy and teaching enjoyment, with this indirect pattern varying by age. Among younger teachers (20–40 years), ICT self-efficacy was positively associated with ICT engagement, and engagement, in turn, showed a positive association with teaching enjoyment. This configuration is broadly consistent with propositions from Self-Determination Theory, which links perceived competence with autonomous, intrinsically oriented activity, and Flow Theory, which emphasizes the experiential value of perceived alignment between skills and task demands [25,18]. From a Broaden-and-Build perspective, positive affect accompanying engagement may be associated with broader cognitive and behavioral repertoires that co-occur with sustained involvement in ICT-related practices [29]. Taken together, these theoretical lenses help contextualize why ICT engagement tends to show a stronger association with enjoyment among younger teachers.

By contrast, among older teachers (≥ 41 years), the indirect association between ICT self-efficacy and teaching enjoyment via ICT engagement was negligible. This pattern is consistent with previous research indicating that later-career teachers often relate to technology in more selective or instrumental ways, associated with career-stage priorities and well-established pedagogical identities [35,40]. Even when older teachers report moderate to high levels of ICT self-efficacy, engagement levels may vary due to perceived misalignment between digital practices and instructional values, institutional constraints, or earlier experiences with technology [34,45]. Such contextual and experiential factors may help explain why ICT use carries less emotional salience for some later-career teachers, which is consistent with the observed absence of a significant indirect association in this age group.

Overall, this pattern underscores the relevance of age as a moderator variable in technology-related affective processes. Although ICT self-efficacy mirrors teachers' confidence in their digital capabilities, its association with teaching enjoyment appears to be associated with engagement behaviors that are themselves shaped by career-stage expectations, professional identity, and contextual affordances.

From the Uses and Gratifications perspective, younger teachers may be more inclined to engage with ICT in ways that correspond with preferences for novelty, social interaction, and professional development, while older teachers may orient toward technology in more instrumental or stability-focused ways [7,8]. Explanations grounded in the Technology Acceptance Model, which emphasize perceived usefulness and ease of use, also help contextualize these differences [10,11], though such models place less emphasis on motivational and affective dimensions.

Despite lower ICT engagement among older teachers, overall enjoyment levels were comparable across age groups, suggesting that teaching enjoyment may be sustained through alternative sources such as pedagogical mastery and relational competence [42,52]. Taken together, these findings highlight that ICT engagement represents one of several pathways associated with positive affective experiences in teaching and that technology-related engagement is neither a necessary nor a uniformly salient correlate of teaching enjoyment across age groups.

The results are consistent with an integrative framework in which psychological needs, engagement experiences, and contextual affordances jointly shape teachers' emotional responses to ICT.

Conclusions

The present study explored associations among ICT self-efficacy, ICT engagement, and teaching enjoyment among Iranian high school EFL teachers, with age examined as a moderating variable. The findings show that ICT self-efficacy is positively associated with both ICT engagement and teaching enjoyment; however, the strength and configuration of these associations vary across age groups. For younger teachers, ICT engagement displayed a stronger association with teaching enjoyment, and the indirect association between self-efficacy and enjoyment via engagement was evident only within this group. Among older teachers, ICT engagement was weakly associated with enjoyment, and the indirect pattern was negligible. Together, these results suggest that the emotional correlates of ICT use are not uniform and appear to be linked not only to perceived competence but also to how digital practices align with teachers' pedagogical routines, motivational orientations, and available emotional resources. The findings highlight the importance of considering career-stage differences when examining the affective dimensions of ICT use.

In practical terms, the findings point to several considerations for policy and teacher development. Professional learning initiatives may benefit from greater sensitivity to career stage: younger teachers tend to report higher engagement with ICT, whereas older teachers may prefer more structured and pedagogically aligned forms of digital integration. Beyond the development of technical skills, professional support may place greater emphasis on meaningful engagement, autonomy-supportive practices, and opportunities for intrinsically rewarding use of technology. Ensuring equitable access to digital resources and

allowing flexibility in how ICT is adopted may help address age-related differences in engagement and emotional experience.

Future studies might build on this work by using longitudinal or mixed-method designs to explore how ICT self-efficacy, engagement and teaching enjoyment evolve together. Further attention to institutional culture, resource conditions and professional identity may also clarify the contextual factors in teachers' affective experiences with technology. Focusing on these dimensions could help provide a more nuanced insight into the ways ICT relates to both teaching practices and enjoyment in EFL contexts.

Authors' Contribution

The corresponding author assumed the responsibility for all aspects of this research. This includes the conception and design of the study, data acquisition, and interpretation of the data. The corresponding author was also solely responsible for drafting the manuscript, performing critical revisions for important intellectual content, and conducting the statistical analysis. All tasks related to obtaining funding, providing administrative, technical, or material support, and supervision were carried out exclusively by the corresponding author.

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Conflict of Interest

The author has no personal or financial interests that could potentially influence this work.

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AUTHOR(S) BIOSKETCHES

Reza Nejati is an associate professor of Teaching English as a Foreign Language (TEFL) at Shahid Rajaee Teacher Training University. His research interests include teaching and assessing language skills.

Nejati, R., Associate Professor, TEFL. English Department, Shahid Rajaee Teacher Training University, Tehran, Iran.
reza.nejati@sru.ac.ir

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