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Digital skills infusion in curriculum development: investigating instructors' perspectives

Integrazione delle competenze digitali nello sviluppo dei programmi di studio: analisi delle prospettive dei docenti

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Abstract
The current study explores college instructors' perspectives on digital skills integration in early childhood education curricula at higher education institutions. A mixed-methods approach is adopted with a pre-existing questionnaire composed of 14 items and semi-structured interviews. Data were collected from nine universities across the Middle East, targeting 464 college instructors. The findings indicate a disposition among college instructors toward acquiring and refining digital competencies related to pedagogical practices and learning modalities, underscoring the significance of integrating digital elements into curriculum content. College instructors expressed the least favorable views regarding the limited inclusion of digital tools and resources in the curricula. Two themes emerged from the qualitative data: positive perspectives, and negative perspectives to integrate digital skills into the curriculum. The study emphasizes the need for incorporating digital components into curriculum design to better equip educators and learners in early childhood education within higher education settings.

Keywords: Curriculum development, digital skills, early childhood education, Middle East.

Riassunto
Questo studio esplora le prospettive dei docenti universitari sull'integrazione delle competenze digitali nei curricula di educazione della prima infanzia presso le istituzioni di istruzione superiore. È stato adottato un approccio metodologico misto, utilizzando un questionario preesistente composto da 14 domande e interviste semi-strutturate. I dati sono stati raccolti in nove università del Medio Oriente, coinvolgendo 464 docenti universitari. I risultati indicano una propensione da parte dei docenti ad acquisire e perfezionare competenze digitali legate alle pratiche pedagogiche e alle modalità di apprendimento, evidenziando l'importanza di integrare elementi digitali nei contenuti curriculari. I docenti hanno espresso opinioni meno favorevoli riguardo alla scarsa presenza di strumenti e risorse digitali nei curricula. Dai dati qualitativi sono emerse due tematiche principali: prospettive positive e prospettive negative sull'integrazione delle competenze digitali nel curriculum. Lo studio sottolinea l'urgente necessità di incorporare componenti digitali nella progettazione curricolare per preparare meglio educatori e studenti nel campo dell'educazione della prima infanzia all'interno del contesto universitario.

Parole chiave: sviluppo del curriculum, competenze digitali, educazione della prima infanzia, medio oriente.

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1. Introduction

Higher education serves as a cornerstone of societal transformation, driving economic, cultural, and technological progress (Land et al., 2021; UNESCO, 2016). Its curricula act as blueprints for shaping future generations, embedding the knowledge, skills, and values essential for navigating an increasingly digital world (Leal Filho et al., 2018; Redding et al., 2019). As technological advancements redefine societal demands, early childhood education (ECE) curricula must evolve to equip pre-service teachers with competencies that bridge pedagogical expertise and digital fluency (Varghese & Musthafa, 2022). However, merely incorporating Information and Communication Technology (ICT) into curricula is in-sufficient. A cultural shift toward digital proficiency is required (Varghese & Musthafa, 2022; Luna Scott, 2015). Pre-service teachers need digital literacy to critically evaluate and creatively use tools (e.g., in-teractive apps, digital storytelling platforms) (Ruiz et al., 2022). Moreover, they need pedagogical inte-gration to embed ICT into curriculum design (e.g., using VR for immersive learning) and teaching strategies (e.g., adaptive software for differentiated instruction) (Punie & Redecker, 2017). Additionally, technological intelligence is needed to align digital tools with developmental goals (e.g., leveraging tablets to foster fine motor skills or collaborative problem-solving) (Luna Scott, 2015). While ICT offers transformative potential in enhancing engagement, accessibility, and personalized learning (Adamu et al., 2020), its role must be complementary, not substitutive. Empirical studies un-derscore that teacher guidance remains irreplaceable in scaffolding children's socio-emotional and cog-nitive development, even in digital environments (Van Dinh et al., 2025). For instance, a meta-analysis by Archana (2025) found that ICT interventions lacking teacher mediation yielded minimal learning gains in ECE settings. To facilitate effective change, restructuring should begin by defining clear ICT skills and addressing systemic barriers such as faculty training gaps, resource disparities (Stevens, 2025).This study examines the extent to which ECE curricula in higher education institutions cultivate com-petencies in using ICT tools, drawing on faculty and pre-service teacher perspectives to identify actionable pathways for reform. Academic perspectives on curriculum reforming are crucial as they are messengers of the transformations, bringing their expertise, research, and pedagogical innovation. Recent research critically evaluates the extent of ICT integration in the curriculum, which has to serve as the starting point for fostering meaningful transformations in higher education, ensuring curriculum relevance and re-sponsiveness to emerging educational paradigms and societal imperatives.

2. Problem statement

Teacher training curriculum needs to be formulated to fit the demands of the digital era as shifts in society and technology persist in shaping our lifestyles and professions. The curriculum has to evolve to guarantee that pre-service teachers possess the essential competencies. Therefore, the incorporation of digital skills into the curriculum framework should reflect the current requisites of society and the job market; it is a fundamental need for success across diverse occupations and daily affairs, and it fosters the capacity for innovative thinking among students, enabling them to devise creative solutions. Integrating digital literacy skills into the curriculum requires meticulous planning and continuous refine-ment. The aim extends beyond mere technological usage, seeking to empower students to engage with digital tools effectively, ethically, and responsibly. The educational framework serves as the foundational structure through which ICT competencies are developed, ensuring that students are well-prepared to navigate the opportunities and challenges of an increasingly digital world. Strengthening teachers' digital competencies through comprehensive pre-service academic training is therefore fundamental. Such train-ing fosters a pedagogical environment where digital approaches to teaching are not only encouraged but meaningfully applied. To achieve the learning outcomes, academic courses are thoughtfully designed and implemented with a strong ICT orientation. The role of college instructors—including their needs, experi-ences, and feedback—is instrumental in shaping courses that are both relevant and impactful. Technology plays a huge role in ECE by making building and transmitting knowledge easy. With the advance of globalization, the pedagogical role achieved efficiency in using technological contributions in education or the learning of teachers and students (Bocconi et al., 2012). The ICT skills encompass the proficiencies and knowledge necessary

to carry out practical tasks expected of both instructors and students within an educational context (Kaxinga, 2021). Results show growing interest in digital literacy, with a predominant use of qualitative research methods. The identified major themes and their associated categories provide a comprehensive overview of the diverse aspects covered in the literature (Jabbarova, 2020). The role of ICT skills is facilitating the operational processes within a workplace setting. Within the realm of higher education, there is a focus on providing various computer-related skills with different tools to en-hance the ICT skills of educators (Smith, & Johnson, 2019; Ahmad et al., 2018). ICT skills are significant in the making decision processes of ICT educators, underscoring their importance for professionals (Ahmad et al., 2018). In addition to the focus on ICT skills, it is crucial to consider the broader concept of digital literacy. As-tematic review of digital literacy emphasizes the significance in the context of Smart Learning Environments (Chae, et al., 2014). This review provides comprehensive insights into the dimensions of digital literacy, which may encompass the proficiencies and knowledge necessary for performing practical tasks within educational settings. As we explore the infusion of ICT skills in ECE, understanding the broader spectrum of digital literacy becomes pertinent, considering its implications for educators and students. The integration of Science, Technology, Engineering, and Mathematics (STEM) in ECE has been a subject of growing in-terest. Yücelyi it and Toker (2021) conducted a meta-analysis on STEM studies, specifically in ECE, shedding light on the effectiveness and outcomes of such initiatives. This meta-analysis not only contributes to the understanding of STEM education but also holds relevance for our exploration of ICT skills infusion in early childhood curriculum content. The findings may provide insights into the holistic development of skills, including technological and problem-solving abilities, as part of STEM education initiatives in early childhood. Educators' preparation and professional development play a core role in the successful integration of STEM in ECE. Suryadi et al. (2023) conducted a literature review focusing on STEM teacher professional devel-opment within pre-service teacher education programs. This review sheds light on the current practices and challenges in preparing future educators to effectively incorporate STEM elements into their teaching practices. Considering the interconnectedness of STEM and the infusion of ICT skills in ECE, understanding the landscape of STEM teacher professional development becomes pivotal to enhancing the overall edu-cational experience. Valverde-Berrocoso et al. (2020) conducted a systematic literature review examining trends in educational research related to e-learning. Findings offered valuable insights into the evolving landscape of e-learning, showcasing emerging themes, methodologies, and areas of focus within the educational research commu-nity. Understanding the trends becomes crucial for researchers investigating the integration of ICT skills in ECE, as it situates their work within the broader context of educational transformation driven by digital innovation. The results contribute to our awareness of the evolving nature of e-learning practices and emphasize the significance of technology integration in shaping contemporary ECE environments. Brown and Martinez (2020) conducted a meta-analysis of thirty studies related to ECE, evaluating the ef-fectiveness of technology integration—an area that aligns closely with the focus of the present study on early childhood curriculum. The findings of their meta-analysis, which incorporated both qualitative and quantitative data, indicate that technology has a significant and positive influence on literacy development. Specifically, it enhances children's engagement and social interactions, as well as supports improvements in sequencing, visual perception, creative thinking, and fine motor skills. Despite these encouraging outcomes, the analysis also notes ongoing methodological concerns that warrant attention. Further supporting this perspective, Lee and Anderson (2021) identified a positive correlation between the use of technology and increased levels of engagement among children. Additionally, interviews conducted in related studies re-vealed that contextually grounded professional development activities helped create environments that support teachers' decisions to integrate technology into their practices (Pinto-Santos et al., 2022; Garcia & Kim, 2018). Beyond the classroom, elements such as curriculum content, instructional strategies, and teaching materials are also critical in higher education contexts for fostering ICT competencies among learners (Garcia & Kim, 2018). The current study explores ICT skills infusion in curriculum content, materials, and teaching strategies to nurture pre-service teachers' skills. Research addressing ICT skills in the context of curriculum development is limited (Sabin et al., 2018). In a descriptive study conducted on high school students, the majority of participants had positive opinions and views on the relative advantage of ICT integration. Practicing digital tools makes them able to apply the tools within their teaching practices in the classroom context (Ashraf et al., 2022), and positive impact of technology on social interactions such as cooperation, sharing,

and collaboration (Biasutti, 2011; 2017; Biasutti & Frate 2018; Brown & Martinez, 2020). It be-comes essential to assess the effectiveness of collaborative behaviors, particularly among students engaged in online learning courses, for localized comprehension. Looking ahead, ICT in education could play a key role, but it cannot completely replace the teacher in the classroom (Archana, 2025; Stevens, 2025). The connection of various tools, dynamism, and progressiveness suggests that the use of virtual worlds and simulations in learning is accepted (Budic et al., 2022). Pre-service training experiences are the proper contexts in which primary teachers adopt a digital perspective toward learning and developing ICT skills to be integrated into their educational activity. In academic courses, prospective teachers can find role models for implementing digital teaching strategies in professors and instructors (Hammond, et al. 2009). While the importance of ICT competencies in education is widely acknowledged (Garcia & Kim, 2018), there is a need to investigate how these competencies are embedded within curriculum content—particularly from the perspective of university instructors. Despite growing interest in technology integration, limited research has examined the specific inclusion of ICT-related content in early childhood education (ECE) curricula (Budic et al., 2022). This study aims to assess the current status of ICT competencies in the ECE curricula to inform improve-ments in curriculum design and development. It also seeks to identify existing needs and establish a strategic roadmap for enhancing ICT competencies in ECE. This study will seek to answer the following questions.

1. To what extent are ICT competencies included in ECE curricula at higher education institutions, according to university faculty members?
2. Are there statistically significant differences ($p < 0.05$) in university faculty members' perceptions of the availability of ICT competencies in ECE curricula based on demographic variables such as gender and professional experience in teaching ECE programs?

3. Methodology

This study adopted a mixed-methods research (MMR) design, combining quantitative and qualitative ap-proaches to explore the availability of ICT competencies in ECE curricula across higher education institu-tions. The perspectives of university faculty members and preservice teachers were examined to triangu-late findings and enrich interpretation. Because the quantitative data measure the perspectives of universi-ty faculty members and preservice teachers are linked to their in-depth qualitative interpretations of their perceptions, it is clear that the qualitative approach helps in interpreting the quantitative results, which re-quired the use of the mixed method in this study. The mixed method frees the research from the restrictions imposed using one of the two methods (Creswell & Clark, 2017). Further, the mixed method rids the re-search of the weaknesses and limitations of using a single method and brings together the strengths of the two methods (Krippendorff, 2004). The study employed a convergent parallel mixed-methods design (Cre-swell & Clark, 2017), wherein quantitative and qualitative data were collected simultaneously, analyzed separately, and then integrated during interpretation. This design was selected due to complementarity which combines and uses qualitative insights (e.g., open-ended responses) to contextualize and explain quantitative trends (e.g., survey scores). Moreover, it offers triangulation that is related to cross-validate results from both datasets to strengthen conclusions. Additionally, it minimizes the limitations of standalone methods (e.g., quantitative breadth vs. qualitative depth) (Creswell & Clark, 2017; Hunter, & Brewer, 2003; Krippendorff, 2004). The integration of data occurred at the interpretation stage, where qualitative themes (e.g., faculty perceptions of ICT integration challenges) were juxtaposed with quantita-tive patterns (e.g., frequency of ICT-related curriculum components).

3.1 Study Instrument

A questionnaire was adapted from a pre-existing scale for data collection in this study (Brown, & Martinez, 2020). The questionnaire consisted of 14 items, and collected responses from 464 participants using a 5-point Likert scale. There are three dimensions: content, material, and ICT skills, with counts of four, four, and six items, respectively. A pilot study involving 43 individuals was conducted to ensure the questionnaire's validity and reliability. Rigorous attention was given to ensure that all items within the questionnaire were easily comprehensible, leading to successful completion by the participants. For qualitative data, open-ended survey responses and semi-structured interviews were conducted with faculty members from different programs at nine universities situated in the Middle East. Ethical clearance was sought from the ethics committee of the selected universities before data collection. All participants provided their informed consent before participating in the study.

3.2 Participants

A purposive sampling technique was used to select universities already implementing blended learning, ensuring participants had direct experience with ICT in ECE curricula. From these institutions, 500 questionnaires were distributed to faculty and preservice teachers; 464 were completed (92.8% response rate). The universities selected for the study were already providing blended learning courses, with a recognition of the significance of ICT competencies across curriculum content, curriculum materials (CM), and teaching strategies (TS). A subset of 30 participants (15 faculty, 15 preservice teachers) was selected for in-depth interviews to explore emergent survey themes. Demographic details (e.g., gender, years of experience, institution type) are provided in Table 1.

Variable	Options	N.	%
Country of the institution	Jordan	168	36.21
	Egypt	186	40.09
	Palestine	110	23.70
	Total	464	
Gender	Male	183	39
	Female	278	60
	Prefer not to answer	3	1
	Total	464	
Age	< 40	360	77.59
	40-59	88	18.96
	60 and over	16	3.45
	Total	464	
Degree	Bachelor	295	63.58
	Master	24	5.17
	PhD	110	23.71
	Others	35	7.54
	Total	464	

Tab. 1: Demographic Data

The nationalities of the participants' institutions are Jordan (with respondents from the University of Jordan -JU-, Irbid National University -INU-, Mutah University LTD (MU), Egyptian (from Al-Azhar University -AZHU-, Suez Canal University -SCU- Heliopolis University Association -HUSD-), and Palestinian (from Palestine Technical University Kadoorie-PTUK-, Palestine Technical College – Dier Elbalah-PTC-, Al-Istiqlal University -PASS-). Respondents belonged to several different academic faculties: engineering, applied sciences, business and economics, agricultural science and technology, humanities, IT, graduate studies, physical education and sports sciences, pharmacy, and others. The majority of respondents were female (39% male, 60% female, and 1% other), with 36.6% bachelor holders, 5.2% master's degree holders, and 23.7% Ph.D. holders. In terms of currently teaching in the ECE program 70.9% are not teaching and 29.1% are currently teaching.

3.3 Validity and Reliability of the Study Tool

The study tool underwent rigorous validation procedures to ascertain its validity and reliability. Face validity and construct validity were assessed by administering the translated scale from Arabic to English to professors specializing in educational psychology and educational technology from diverse universities. To evaluate construct validity, principal component analyses with Varimax rotation were conducted (Biasutti & Frezza, 2009). Additionally, the construct validity of the questionnaire was further examined using an exploratory factor analysis approach. Specifically, the study employed a pilot study involving 40 students to assess how well the 14 measured digital items of the scale represented the underlying constructs. Various criteria were employed to determine the factorability of correlations, following the guidelines outlined by Daher (2019). Each scale item was required to correlate with at least three other items. The analysis indicated favorable results, with the Kaiser Meyer-Olkin measure of sample adequacy yielding a value of 0.908, surpassing the recommended threshold of 0.6. Furthermore, Bartlett's test of sphericity returned a significant result ($\chi^2 = 1015.55$, $p < .001$), indicating robust validity of the research data, in line with findings by Cheng and Shao (2022).

No.	Items	Components		
		1	2	3
1	Our curricula give limited space for ICT tools and digital resources used in teaching and learning.	.65		
2	The curriculum goes beyond a concentration on primary education topics and knowledge through the use of ICT resources.	.86		
3	The curriculum guides students to use multiple networked devices, digital resources, and electronic environments to produce knowledge and collaborative learning.	.78		
4	Part of the assessment process uses ICT tools, computers, or online.	.76		
5	The curriculum covers ICT-related topics such as using the Internet for open educational resources.		.80	
6	The curriculum helps students make connections between technology topics they might be interested in and teaching practices.		.76	
7	The curriculum develops ICT employability skills needed for educators.		.71	
8	The curriculum connects students to the world by using modern e-learning tools.		.81	
9	The curriculum emphasizes creating artifacts using different ICT tools and resources that meet the developmental characteristics of students in pre-schools and primary schools.			.69
10	The curriculum is enriched with software-based learning activities such as creating presentations and game creation suitable for primary education.			.83
11	The curriculum emphasizes modern ICT literacy and integration.			.63
12	The curriculum broadly attempts to equip university students in primary education specialization with the ability to use various ICT devices, applications, and resources.			.79
13	The curriculum includes the necessary ICT skills in a variety of specialized courses.			.67
14	I am willing to learn and enhance my ICT skills in teaching and learning.			. 76

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Tab 2: Rotated Component Matrix

Table 2 shows the results of the principal component analysis (PCA) with Varimax rotation, aiming to uncover the underlying structure of items related to the integration of ICT in the ECE curriculum. Three factors emerged, factor 1 refers to curriculum content, factor 2 refers to curriculum material, and factor 3 refers to ICT skills. The analysis reveals distinct components, such as "the ICT Integration in Curriculum Content factor that includes item no. (1-4)," "Curriculum material factor that includes item no. (5-8)," and ICT skills that includes item no. (9-14) reflects the underlying constructs being measured. These components align conceptually with the intended dimensions of ICT integration in educational contexts, indicating strong construct validity. Moreover, the high loadings of individual questionnaire items on their respective components further support the validity of the instrument. Items with loadings above 0.6 demonstrate a strong association with their underlying constructs, indicating that they effectively measure the targeted aspects of ICT integration in curriculum design and educators' attitudes toward ICT adoption. For reliability, Cronbach's alpha is calculated as shown in Table 3.

Dimensions	α	No. of items
Curriculum content	.91	4
Curriculum material	.89	4
ICT skills	.92	6
Total	.97	14

Tab 3: Reliability values of scale dimensions

The Cronbach's alpha value of the whole scale is 0.97 as shown in Table 3, indicating an excellent internal consistency reliability among the 14 items in the questionnaire. A categorization of mean scores has been provided to evaluate the quality of the features described in the constructs of the questionnaire. The explanation of the different quality categories is reported in Table 4.

Mean range	Degree/Class
less than 1.8	Very low
1.8 - 2.59	Low
2.6 - 3.39	Medium
3.4 - 4.19	High
4.2 and above	Very High

Tab 4: Correction key to interpret the study items

Construct	Items	Mean	Standard Deviation	Degree
Curriculum Content	Our curricula give limited space for ICT tools and digital resources used in teaching and learning.	2.93	1.22	Medium
	Part of the assessment process uses ICT tools, computers, or online.	3.10	1.24	Medium
	The curriculum goes beyond a concentration on primary education topics and knowledge through the use of ICT resources.	2.94	1.20	Medium
	The curriculum guides students to use multiple networked devices, digital resources, and electronic environments to produce knowledge and collaborative learning.	3.14	1.26	Medium
Curriculum Material	The curriculum covers ICT-related topics such as using the Internet for open educational resources.	3.16	1.30	Medium
	The curriculum helps students make connections between technology topics they might be interested in and teaching practices.	3.15	1.25	Medium
	The curriculum develops ICT employability skills needed for educators.	3.08	1.26	Medium
	The curriculum connects students to the world by using modern e-learning tools.	3.15	1.26	Medium
ICT skills	The curriculum emphasizes creating artifacts using different ICT tools and resources that meet the developmental characteristics of students in pre-schools and primary schools.	2.98	1.26	Medium
	The curriculum is enriched with software-based learning activities such as creating presentations and game creation suitable for primary education.	3.11	1.26	Medium
	The curriculum emphasizes modern ICT literacy and integration.	3.06	1.26	Medium
	The curriculum broadly attempts to equip university students in primary education specialization with the ability to use various ICT devices, applications, and resources.	3.06	1.22	Medium
	The curriculum includes the necessary ICT skills in a variety of specialized courses.	3.06	1.23	Medium
	I am willing to learn and enhance my ICT skills in teaching and learning.	3.49	1.35	High
	Overall	3.10	1.06	Medium

Tab. 5: The sample properties for the state of the art of ICT in the curriculum

Table 5 indicates that the responses of the study sample towards the state of the art of ICT in the curriculum are in a medium degree, and other sentences are (I am willing to learn and enhance my ICT skills in teaching and learning) with a high degree, and the lowest sentence mean is (Our curricula give limited space for ICT tools and digital resources used in teaching and learning) and with a moderate degree.

4. Data Analysis

To answer the second question: Are there statistically significant differences ($p < 0.05$) in university faculty members' perceptions of the availability of ICT competencies in ECE curricula based on demographic variables such as gender and professional experience in teaching ECE programs? The following group statistics are calculated in Table 6.

Variable: Professional expertise in ECE study programs (*I am currently teaching in an ECE study program).*	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Yes	135	2.97	1.02	.088
No	329	3.16	1.08	.059

Tab. 6: Mean scores and SDs of college instructors who currently teaching in the ECE program (M=2.97) and those who are not (M=3.16).

						95% Confidence Interval of the Difference	
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
Equal variances assumed	-1.73	46	0.08	-0.19	0.11	-0.40	0.02

Tab. 7: Independent t-test for the variable Professional expertise in teaching in ECE study program

An independent t-test was conducted to compare the means of perspectives due to teaching in an ECE study program difference. Table 7 shows no significant difference in perspectives mean between male and female college instructors (t_{462} = -1.73,p= .08).

It is clear from the level of significance (0.08) that it is greater than its value (0.05), which means that there are no differences in the answers of the study sample about the curricula due to the teaching variable in the ECE program.

Gender		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Mean	**Male**	183	3.34	.83	.15
	Female	278	3.38	.88	.13

*** (Responses indicating "prefer not to answer" (n=3) were not included.)**

Tab.8: Group Statistics for the variable *Gender**

Table 8 shows the mean scores and SDs of perspectives of male college instructors (M=3.34) and female college instructors (M=3.38). To examine if there is a statistical difference independent t-test is conducted as shown in Table 8.

	t-test for Equality of Means						
						95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Mean Equal variances assumed	-.18	462	.86	-.03	.20	-.44	.37

Tab.9: Independent t-test of gender variable

Independent t-test was conducted to compare the means of perspectives due to gender differences. Table 9 shows that there is not a significant difference in perspectives mean between male and female college instructors (t_{462}= -.18, p= .86).

4.1 Qualitative data analysis

Semi-structured interviews were conducted after the questionnaire to collect data on the perspectives regarding the infusion of ICT skills in the curriculum. College instructors were asked to appraise the positive and negative perspectives of the curriculum that relate to ICT skills.

By conducting content analysis, the collected qualitative data underwent assessment using the seven stages outlined in Kuckartz (2012). Responses from participants were analyzed via inductive (bottom-up) thematic analysis (Antonini Philippe et al. 2020; Krippendorff, 2004). This approach allowed themes (e.g., "barriers to ICT adoption") to emerge organically from participant narratives rather than pre-existing frameworks. Coding involved iterative cycles of open coding (identifying raw themes), axial coding (grouping into categories), and selective coding (synthesizing core themes).

The initial phase of the process involves analyzing, organizing, and summarizing the text. Subsequently, the principal categories are identified, and the initial coding phase begins for the categories. If necessary, sub-categories could be established, leading to the implementation of the second coding phase. After this, diverse analyses can be carried out, culminating in the final step which involves documenting the procedure and outcomes. Importantly, the spiral process can be restarted as needed.

The initial step in the evaluation process was transcribing the text. Language adjustments were made to ensure clarity and consistency in expression. The second stage encompassed rephrasing the text and pinpointing crucial details. The statements were then organized based on various categories, even though a single statement might relate to multiple subjects. Three primary themes were identified, as illustrated in Table 10 based on the results from the transcription.

Theme	Code	f (%)
Positive perspectives	ICT skills are crucial to achieving educational goals.	10 (52.6)
	ICT skills are needed to search and evaluate information.	4 (21.1)
	ICT skills enhance the curriculum	5 (26.3)
Negative perspectives	Concerns about ICT skills being outdated.	15 (78.9)
	ICT skills deficiency in the curriculum	4 (21.1)
Recommend the implementation of ICT skills within the curriculum.	Yes	17 (89.4)
	No	2 (10.5)

Tab. 10 : Themes and codes

4.2 Qualitative results

Based on the content analysis of the data, the following three themes were found:

Positive perspectives

Most participants show positive perspectives towards implementing ICT skills in the ECE curriculum. A participant commented: "ICT skills like proficiency in productivity software are necessary, and using of educational technologies like learning management systems, and basic coding for z-generation students in their early childhood stage, it facilitates their learning process." Another participant added: "It was too easy for me to enhance my course curriculum with some ICT skills like using WhatsApp, Zoom, Google apps, and using Moodle, these apps are used to communicate as well, and they are useful to be integrated into the course."

Moreover, the participant supported the previous instructor: "I used to let my students use their mobile phones to search and evaluate information, I provide my students with links to websites to access videos and text tutorials."

Also, a participant added: "Yes, some courses that target primary education need enhancements for ICT like using interactive whiteboards, digital storytelling in teaching and learning." There are always better/more education courses to give, and it would never harm but would much help.

Negative Perspectives

Most college instructors showed negative perspectives toward the current presence of ICT skills in the curriculum. A college instructor mentioned:

"The curriculum that I teach is traditional and needs a reform in terms of ICT skills like basic computer operations, internet navigation, online safety, and cybersecurity awareness." Another instructor added: It is imperative to augment curriculum with ICT skills like ethical use of digital resources at the college level, students are still dependent on the lecturer."

Recommendation of ICT skills implementation within in curriculum

Most college instructors recommend that ICT skills should be implemented in the curriculum that they teach. Overall, college instructors are unsatisfied with the curriculum they teach. On the other hand, they generally welcome the integration of ICT skills. Despite the negative responses, instructors highlighted some positive about the ICT skills integration in their curriculum. A college instructor stated: "My students use mobile phones and ICT based mobile applications for learning."

4. Discussion

In addressing the first research question, the results indicated a moderate attitude among college instructors concerning incorporating ICT skills within the established curriculum. College instructors' views are the highest in this sentence "I am willing to learn and enhance my ICT skills in teaching and learning". This could be explained due to the prominent advantages of incorporating ICT into the curriculum. ICT has the potential to enrich educational experiences by granting access to a wide array of information, enabling interactive and captivating content, and nurturing self-directed learning. Numerous prior studies align with this finding (Brown & Martinez, 2020; Entezari et al., 2023; Ertmer et al., 2014; Adamu et al., 2020) and assert that ICT can stimulate advanced cognitive skills, and foster collaboration and innovation, effectively aligning with the crucial 21st-century skills necessary for contemporary success. Additionally, the incorporation of ICT can support personalized learning experiences, allowing students to progress at their own pace and catering to various learning preferences.

Instructors' perspectives on the sentence related to curricula limited space for ICT tools and digital resources used in teaching and learning denoted that to some degree curriculum creates space to integrate ICT skills. It appears that college instructors explicitly can employ Moodle platforms, video conferencing, and interactive whiteboards to upskill students with ICT skills and facilitate their students' learning. This aligns with previous studies (Baroudi & Shaya, 2022; Dolighan, & Owen, 2021), which indicate that college instructors exhibit a strong sense of self-efficacy in utilizing online learning, attributed to the support they receive for designing online instruction and their participation in professional development programs focused on online learning.

A medium mean of perspectives of college instructors was found on curriculum inclusion and the necessary ICT skills; this result is consistent with a previous study conducted by Lim (2022) who discovered that the effective implementation of ICT in educational institutions, taking into account the diverse curriculum designs, requires proactive initiatives. Qualitative results reinforce this discovery, as participants expressed positive attitudes toward enhancing the curriculum with ICT skills. They emphasized the importance of ICT skills in attaining educational objectives and evaluating students' advancement.

To answer the second question, an independent t-test was calculated. No significant gender difference was found. This could be justified by the fact that both genders are interested in implementing ICT skills in the ECE curriculum. Moreover, it seems that male and female students agree on the importance of the inclusion of ICT skills in the curriculum in the same way. Similarly, previous studies' results support these findings. This aligns with the results reported by Pinto et al. (2022) indicating that gender does not play a significant role in shaping perspectives on the ICT skills integration into the curriculum. Similarly, the second aspect, which pertains to the variable of enrollment in the ECE program, reveals no significant differences in perspectives; this underscores the importance of implementing ICT skills in the curriculum, regardless of the specialization of college instructors. Employing a digital ICT curriculum in ECE schools is very important since it supports mastery of basic competencies of digital literacy in children.

Based on the feedback received, there is a need for reform in university-level curricula to incorporate more technological tools. It is essential to provide training for ECE teachers and students in the latest technologies, teaching methods, and educational software that can creatively support children's learning. University-level training should also focus on equipping students and educators with the skills to effectively utilize technological resources in designing and managing both formative and summative assessment tools. Furthermore, it is crucial to emphasize the role of technology in activating educational initiatives and innovative software that promotes the creation of engaging learning activities for children, such as games, electronic stories, and other interactive methods.

The potential impact of ICT in education is vast. Notable advantages encompass accessing information online, employing interactive tools to enhance comprehension of subjects, and eliminating the necessity for extensive traditional reading hours. An ICT-oriented curriculum aims to equip students with proficiency in utilizing diverse devices, tools, applications, and resources. Through adept ICT utilization, students can more successfully attain curriculum objectives, fostering the acquisition of knowledge, skills, and the ability to effectively employ ICT for inquiry, understanding, creation, and communication with others.

5. Conclusions and recommendations

As technology has become integral to our daily lives, it has transformed the educational landscape, particularly in the post-pandemic era. The evolution across various educational domains underscores the necessity of developing curricula infused with ICT skills to align with current technological advancements. Bridging the gap between market demands and the competencies imparted by university programs has become crucial. For instance, children now commence their educational journey with diverse levels of technological literacy due to the ubiquitous presence of ICT. Consequently, it is imperative for educators and university students to be equipped with contemporary ICT skills and tools. The advantages of incorporating ICT in ECE are various, with one notable benefit being its positive impact on students' focus and attention, surpassing the effectiveness of traditional learning methods. Based on the conducted survey, the implementation of the ICT4EDU project (*Enhancing ICT Competencies of Early Childhood Educators at HEIs in MENA Countries (ICT4EDU)*, n. d.) should emphasize the following aspects of ICT based on courses and curriculum development: a continuous review of the curricula to keep balance with the current digital transformation, especially in education, teaching methods and related technology, curricula and teaching courses should highlight the practical development in the field of ICT in education and teaching methods, university staff and students should receive continuous capacity building and training on the latest use of technology, providing the tools that facilitate the use of technology in learning and teaching, and promotion and introduction motivating courses such as computer driving license in the curriculum courses.

6. Practical implications

This study offers critical insights with direct implications for educators and policymakers working to enhance ICT integration in ECE. For educators, the findings underscore the need to move beyond basic digital literacy toward meaningful pedagogical integration of technology. Teachers should receive targeted professional development that emphasizes practical applications, such as using interactive apps to teach problem-solving or digital storytelling tools to boost literacy. Given the study's revelation that instructors are willing to improve their ICT skills but face curriculum constraints, schools should empower teachers to advocate for flexible, ICT-infused lesson plans—for example, by replacing traditional worksheets with tablet-based collaborative activities or using VR to simulate science experiments. Additionally, educators must address equity gaps by leveraging low-cost solutions like mobile-friendly lessons and offline apps, ensuring all students benefit from digital learning. For policymakers, the study highlights systemic barriers requiring urgent action. Teacher training programs must be restructured to embed ICT skills into certification teaching standards. Policymakers should also prioritize infrastructure investments, ensuring schools in underserved areas have reliable devices and internet access, paired with sustainable funding for software updates. Curriculum reforms should introduce clear, age-appropriate ICT benchmarks—such as foundational coding concepts for preschoolers while fostering partnerships with ed-tech providers to scale proven solutions. Crucially, the study's evidence of instructors' enthusiasm for ICT adoption should motivate governments to fast-track policy changes, streamlining bureaucratic processes that delay curriculum updates.

The study's mixed-methods data reveal a pivotal tension: while educators recognize ICT's transformative potential, institutional inertia and resource gaps hinder progress. Bridging this divide demands collaboration—teachers piloting innovative practices, policymakers allocating targeted funding and communities supporting home-school digital literacy initiatives. Education systems have to transform ECE curricula to equip both educators and young learners with the skills needed for a technology-driven future. The time for incremental change has passed; strategic, system-wide action is now imperative.

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