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Effectiveness of Digital Competence on Entrepreneurial Mindset and Lifelong Learning of Students

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ABSTRACT

The present study was conducted to determine the impact of digital competence on entrepreneurial mindset and lifelong learning of sixth-grade female students in Mirjaveh city during 2022-2023 academic years. The research method was quasi-experimental design with pretest-posttest and control groups. The statistical population consisted of all sixth-grade female students in Mirjaveh, and Meraj-2 Elementary School was randomly selected. The sample members included two classes of sixth grade, one assigned as the experimental group and the other as the control group. Students in the experimental group underwent 12 sessions, each lasting 45 minutes, under the supervision of the researcher to acquire digital competence skills. The data collection instruments included the Lifelong Learning Questionnaire (Li & Cheng, 2010) and the Entrepreneurial Mindset Questionnaire (Bahramzadeh et al., 2009). Data analysis was performed using descriptive statistics (mean, standard deviation) and inferential statistics (one-way and multivariate analysis of covariance). The results of the covariance analysis were examined for comparing the scores of entrepreneurial mindset, lifelong learning, and their components between the experimental and control groups in the posttest. The F value for each was significant at that indicating that the effect size of digital competence on entrepreneurial mindset and lifelong learning was significant. Furthermore, considering the higher mean scores of the experimental group students in the posttest, it was concluded that the digital competence has a positive and significant effect on the entrepreneurial mindset and lifelong learning of students.

Introduction

Entrepreneurial mindset denotes individual or organizational traits that increase risk tolerance and foster a propensity for innovation. An entrepreneurial mindset signifies the extent to which an individual or organization is willing to invest financial and temporal capital in undertaking a distinctive task (Crosina et al., 2024). Entrepreneurship education also focuses on bolstering this mindset among researchers in the initial stage (Kamaliahe et al., 2024). Undoubtedly, the trajectory of economic development in developed countries underscores the influence of entrepreneurship on the economy. Identifying opportunities marks the inception of entrepreneurship and the training of lifelong learners and knowledge workers are crucial elements through which higher education can, directly and indirectly, impact the four vital processes of the knowledge economy: production, distribution, dissemination, and application of knowledge (Daspit, Fox, & Findley, 2023).

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Lifelong learning is a form of voluntary learning aimed at achieving personal satisfaction (whether for personal interests and enthusiasms or for professional career aspirations in the workplace) and may involve formal (academic studies at universities or educational institutions) or informal pursuits (Thwe & Kálmán, 2024). Lifelong learning encompasses learning at all stages of life and in all domains of individual and social life, striving for continuous learning throughout all phases and periods of life to adapt to life changes and secure a good life for oneself at every stage. Lifelong learning offers various tools, one of which is the use of information and communication technology. These tools assist people in increasing their knowledge and information through networking and interaction with people worldwide and provide avenues for income generation (Håkansson Lindqvist et al, 2024).

To educate all age groups, especially children in a school setting, transformations are necessary. Strategies can be devised to facilitate these transformations. Specialized education, such as digital competence, can be utilized to enhance their skills(De Obesso, Núñez-Canal, & Pérez-Rivero, 2023). Digital competence, defined as education beyond digital literacy, encompasses higher learning beyond digital literacy, which includes content creation and animation, after students become familiar with digital literacy (Su & Yang, 2024), utilizing electronic tools such as animation software like Scratch Junior and goal-based instructional methods, providing feedback, and monitoring progress through scoring or other methods (Pedaste, Kallas, & Baucal, 2023).

Digital competence is one of the eight key skills for lifelong learning that every citizen should develop by the end of their basic education. In this regard, teachers themselves will be fundamental and responsible for developing digital competencies in future generations (ElSayary, 2023). Digital competence of students is related to all the knowledge, skills, and attitudes necessary in the digital world and affects educational strategies directly or indirectly related to technology and involves safe, critical, and responsible use of digital technologies for learning et al., 2023).

Students should be allowed and encouraged to use information and communication technology for learning tasks, information searching, and information creation. In this way, they learn to be critical and creative by considering specific considerations such as searching for relevant information, evaluating the reliability of online information, critically approaching online publishing, and using digital tools and media in various subject areas. Innovative learning approaches also support digital competence (Méndez et al., 2023). The integration of information and communication technology into education through innovative approaches to independent learning is subject-agnostic. Information and communication technology has the potential to place learners at the center and actively engage them in the learning process, enhancing experiential and discovery-based learning, problem-solving skills, and more (Pakhomova et al., 2023).

Digital competence is one of the eight key skills for lifelong learning that every citizen should develop by the end of their basic education (Gabarda Méndez et al., 2023). Developing entrepreneurial competence among students requires teachers' mastery of concepts. Teacher training in entrepreneurship education helps them utilize specific competencies, methods, and tools to encourage learners' self-confidence and stimulate flexibility, leadership, and innovation (Huu, 2023).

Given the above explanations, this study aimed to investigate effectiveness of digital competence on entrepreneurial mindset and lifelong learning of students.

Taking a cursory glance at the educational landscape, we observe an increasing presence of information and communication technology (ICT) in classrooms across various educational levels. Consequently, many experts have stated that developing digital teaching skills poses a challenge for future generations and is a challenge that must be addressed in the face of rapid technological advancements in our current era. Moreover, the prerequisites for students' success in digital learning encompass organizational skills, particularly in higher education. These skills demonstrate how engaged students are in their learning process in terms of motivation, metacognition, and behavior. These factors include the proactive role and self-determined strategies of students in achieving academic success and specific goals in the learning process and entrepreneurial development. With these considerations in mind, the urgent need for students to acquire digital competencies for entry into the job market and to foster an entrepreneurial mindset and a

desire for lifelong learning is keenly felt in today's society and world. Therefore, there is a need for applied research to address these issues and challenge them. The most important stakeholders and beneficiaries of the results of this research include the Ministry of Education, universities and higher education institutions, students in entrepreneurship programs, enthusiasts of information technology and entrepreneurship research, and teachers and students at various educational levels.

Research questions

Does the implementation of the digital competency program have a significant impact on the entrepreneurial mindset and lifelong learning of students?

1. Does the digital competency program significantly affect entrepreneurial mindset of students?
2. Is the digital competency program on each component of students' entrepreneurial mindset different?
3. Does the digital competency program have a significant effect on the lifelong learning of students?
4. Is the digital competency program on each component of students' lifelong learning different?

Research Method

This research is quasi-experimental design with a pretest-posttest and control group.

Sample and Sampling Method

The statistical population of consisted of all sixth-grade female students in elementary schools in Mirjaveh city during 2022-2023 academic year, totaling 530 individuals. The sampling method in this study was simple random sampling. Among the 11 elementary girls' schools in Mirjaveh city, Meraj 2 Elementary School was randomly selected to implement the digital competency program. 62 students, including two classes of 31 students each from the sixth grade, were considered as the sample. Through random selection, one class was designated as the experimental group and the other as the control group. The Entrepreneurial Mindset and Lifelong Learning Literacy questionnaires were administered to both groups. Subsequently, the experimental group students underwent a 12-session digital literacy program, supervised by the researcher, for 45 minutes each session, covering digital literacy, office software, and Scratch programming. Finally, questionnaires were redistributed to both groups for post-assessment, and the analysis was conducted based on the complete set of 62 questionnaires. Criteria for inclusion in this program included age, grade level, and socioeconomic status of the families.

Tools Used

Lifelong Learning Literacy Questionnaire

Lifelong Learning Literacy Questionnaire devised by Li & Cheng (2010) to assess the life learning literacy of individuals. This questionnaire has 27 items and it assesses two domains, namely; learning input and learning process. Learning input consists of four dimensions; self – awareness, learning awareness, cognitive ability, and information retrieval. Learning process has two dimensions; framing learning plan and capabilities of using learning strategies. The Cronbach's alpha coefficients for the components of the Lee and Tsai questionnaire ranged from 0.78 to 0.93, with an overall Cronbach's alpha coefficient of 0.95.

Entrepreneurial Spirit Questionnaire

Entrepreneurial spirit questionnaire was intervened by Bahramzadeh et al. (2009) to assess the level of entrepreneurial mindset of individuals. This questionnaire consists of six domains of creativity, motivation for progress, self-esteem, monitoring source, risk-taking, and foresight. The entrepreneurial spirit questionnaire answered 41 closed-ended questions and 4 open-ended questions and was prepared and compiled with the aim of measuring the level of entrepreneurial spirit in students. In the study by

Bahramzadeh et al. (2009), the content validity of the entrepreneurial spirit questionnaire was confirmed by experts, and its reliability was reported as .85 using Cronbach's alpha.

These questionnaires were administered in a field setting by obtaining permission from the educational authorities of Meraj-2 Elementary School in Mirjaveh city to conduct the digital competency training for the experimental group. The digital competency program included:

1. Digital literacy training (familiarization with hardware, Windows environment, and computer operation).
2. Training in office software.
3. Scratch programming and designing educational animations.

Procedure

After obtaining permission from the Department of Education for the implementation of the project, one of the elementary girls' schools in the Mirjaveh city was randomly selected. From among the sixth-grade classes in this school, one class was randomly assigned as the experimental group, and the other as the control group. The criteria for participation in this project included age, grade level, as well as the socioeconomic status of the families. A pre-test of entrepreneurial mindset and lifelong learning was administered to both groups. Then, the independent variable (digital competence intervention) was taught to the experimental group over 12 sessions. This intervention comprised the identification of diverse computer hardware to facilitate the acquisition of digital literacy. Subsequently, participants were instructed on the utilization of software, including the Scratch Junior program. Following the conclusion of the instructional sessions, both groups underwent a post-test assessment.

Results

For the analysis of the collected data, descriptive statistics (e.g., descriptive indices, mean, and standard deviation) were employed alongside inferential statistics (such as Analysis of Covariance (ANCOVA) and Multivariate Analysis of Covariance (MANCOVA) to dissect and examine each hypothesis proposed in the research

The findings regarding mean and standard deviation of the pre-test and post-test entrepreneurial mindset scores are presented in table 1, disaggregated by experimental and control groups.

Table 1 Descriptive Statistics of Pre-test and Post-test for Entrepreneurial Mindset by Group

Group	Variable	Phase	Mean	SD
Experiment	Entrepreneurial Mindset	Pre-test	88.64	8.48
	Entrepreneurial Mindset	Post-test	122.61	7.26
Control	Entrepreneurial Mindset	Pre-test	93.64	7.11
	Entrepreneurial Mindset	Post-test	103.12	8.43
Experiment	Lifelong Learning	Pre-test	107.09	9.18
	Lifelong Learning	Post-test	142.38	11.33
Control	Lifelong Learning	Pre-test	109.19	10.23
	Lifelong Learning	Post-test	117.03	9.66

The data presented in Table 1 indicates that the mean entrepreneurial mindset scores in the pre-test and post-test phases were 88.64 and 122.61 for the experimental group, and 93.64 and 103.12 for the control group. The mean lifelong learning scores in Table 2 were 107.69 and 142.38 in the pre-test and post-test phases for the experimental group, and 109.19 and 117.63 for the control group.

To investigate the impact of implementing the digital competency program on the entrepreneurial mindset of students, and to answer the first research question regarding whether the implementation of the program affects students' entrepreneurial mindset, a univariate analysis of covariance was employed.

Table 2 ANCOVA for comparing the entrepreneurial mindset in experimental and control groups

Source of Changes	sum of squares	df	Mean of squares	F value	Sig.	η^2
Pre-test	138.662	1	138.662	2.026	0.16	0.033
Entrepreneurial Mindset	5307.373	1	5307.373	77.544	0.0001	0.568
Error	4038.177	59	68.444			
Total	806357.00	62				

The ANCOVA results comparing the scores of entrepreneurial mindset of students in the experimental and control groups at posttest phase reveal that there is significant difference F(1,59)=77.544, P=.0001, η^2=.568 between experimental and control groups. The effect size of implementing the digital competence program on students' entrepreneurial mindset is 56.8%. Therefore, considering the higher mean scores of the experimental group at the posttest, it can be concluded that the implementation of the digital competence program has a positive and significant effect on students' entrepreneurial mindset.

To address the second question and examine whether the effect of implementing the digital competence program on each of the components of students' entrepreneurial mindset differs, a multivariate analysis of covariance MANCOVA was employed.

Table 3 Results of MANCOVA to compare components of entrepreneurial mindset

Effect	Test	Value	df1	df2	Sig.	η^2
Group	Pillai's Trace	0.724	6	49	.0001	.724
	Wilks' Lambda	0.276	6	9	.0001	.724

As seen in table 3, the results of Wilks' Lambda showing that there is significant difference between experiment and control groups on the components of entrepreneurial mindset Wilks' Lambda is equal to .724. Furthermore, the effect size of implementing the digital competency program on the components of students' entrepreneurial mindset is 72.4%.

Table 4 Results of MANCOVA Comparing of entrepreneurial mindset components of experimental and control groups in post-test

Variable	Source	Sum of Square	df	Mean of square	F	Sig.	η^2
Creativity	Between-groups	226.04	1	226.04	37.571	.0001	.410
	Within-groups	324.89	54	6.02			
	Total	24388	62				
Motivation for Progress	Between-groups	93.81	1	93.81	39.937	.0001	.425
	Within-groups	126.84	54	2.35			
	Total	21059	62				
Risk-taking	Between-groups	468.36	1	468.36	64.626	.0001	.545
	Within-groups	391.35	54	7.25			
	Total	24100	62				
Foresight	Between-groups	123.62	1	123.63	23.219	.0001	.301
	Within-groups	287.51	54	5.32			
	Total	24516	62				
Internal Locus of Control	Between-groups	58.70	1	58.70	23.189	.0001	.300
	Within-groups	136.68	54	2.53			
	Total	20152	62				
Self-esteem	Between-groups	140.25	1	140.25	26.729	.0001	.331
	Within-groups	283.34	54	5.25			
	Total	21812	62				

The results of MANCOVA showing that there is significant differences on entrepreneurial mindset components namely; creativity F(1,54)=37.571, P=.0001, η^2=.41, motivation for progress F(1,54)=39.937, P=.0001, η^2=.425, risk – taking F(1,54)=64.626, P=.0001, η^2=.545, foresight F(1,54)=23.219, P=.0001,

η^2=.301, internal locus of control F(1,54)=23.189, P=.0001, η^2=.300, and self – esteem F(1,54)=2.729, P=.0001, η^2=.331 between experimental and control groups in the post-test phase.

To examine the impact of implementing the digital competency program on lifelong learning of students and address the third research question, a one-way analysis of covariance (ANCOVA) was employed.

Table 5 Results of MANCOVA for comparing lifelong learning between experimental and control groups

Variable	Sum of squares	Df	Mean of squares	F value	Sig.	η^2
	279.223	1	279.223	2.583	0.11	0.041
Lifelong learning	10210.777	1	10210.777	94.469	0.001	0.616
	63770. 099	59	108.086			
	1059746	62				

The ANCOVA results comparing the scores of lifelong learning of students in the experimental and control groups at posttest phase reveal that there is significant difference F(1,59)=94.469, P=.0001, η^2=.616 between experimental and control groups. The effect size of implementing the digital competence program on students' lifelong learning is 61.6%. Therefore, considering the higher mean scores of the experimental group at the posttest, it can be concluded that the implementation of the digital competence program has a positive and significant effect on students' lifelong learning.

To investigate whether the impact of implementing the digital competency program on each of the components of students' lifelong learning is different and to address the fourth research question, MANCOVA was conducted.

Table 6 Results of MANCOVA for Comparing Lifelong Learning Components

Effect	Test	Value	F	df1	df2	Sig.	η^2
Group	Pillai's Trace	.688	12.39	8	45	.0001	.688
	Wilks' Lambda	.312	12.39	8	45	.0001	.688

As seen in table 6, the results of Wilks' Lambda showing that there is significant difference between experiment and control groups on the components of lifelong learning components Wilks' Lambda is equal to .312. Furthermore, the effect size of implementing the digital competency program on the components of students' lifelong learning components is 31.2%.

Table 7 Comparing lifelong learning components the experimental and control groups in post-test

Variables	Source	Sum of squares	Df	Mean of square	F	Sig.	η2
Self-awareness	Between-groups	160.85	1	160.85	32.568	.0001	.385
	Within-groups	3256.82	51	4.94			
	Total	15365	62				
Learning awareness	Between-groups	139.87	1	139.87	28.506	.0001	.354
	Within-groups	255.15	51	4.91			
	Total	12751	62				
Information retrieval ability	Between-groups	61.48	1	61.48	13.869	.0001	.211
	Within-groups	230.53	51	4.43			
	Total	15199	62				
Learning program creation	Between-groups	106.87	1	106.87	18.776	.0001	.265
	Within-groups	295.98	51	5.69			
	Total	15323	62				
Use of learning strategies	Between-groups	111.53	1	111.53	19.420	.0001	.272
	Within-groups	298.64	51	5.74			
	Total	15588	62				
Learning time planning and management	Between-groups	156.74	1	156.74	25.870	.0001	.332
	Within-groups	315.05	51	6.06			
	Total	12735	62				
Collaborative learning	Between-groups	160.13	1	160.13	38.405	.0001	.425
	Within-groups	216.81	51	4.17			
	Total	12493	62				
Learning assessment and transfer	Between-groups	190.30	1	190.30	27.317	.0001	.344
	Within-groups	362.25	51	6.97			

Total	41338	62

The results of MANCOVA showing that there is significant differences on lifelong learning components namely; self – awareness F(1,51)=32.568, P=.0001, η^2=.385, learning awareness F(1,51)=28.506, P=.0001, η^2=.354, information retrieval ability F(1,51)=13.869, P=.0001, η^2=.211, learning program creation F(1,51)=18.776, P=.0001, η^2=.265, use of learning strategies F(1,51)=19.42, P=.0001, η^2=.272, and learning time planning and management F(1,51)=25.87, P=.0001, η^2=.332, collaborative learning F(1,51)=38.405, P=.0001, η^2=.425, and learning assessment and transfer F(1,51)=27.317, P=.0001, η^2=.344 between experimental and control groups in the post-test phase**.**

Di s c u s s i o n

In response to the first research question, the results for comparing students' entrepreneurial mindset in the experimental and control groups in the post-test phase showing the higher mean scores of the experimental group in the post-test, it can be concluded that the implementation of the digital competency program had a positive and significant effect on students' entrepreneurial mindset. The results of this study are consistent with the findings of previous research (Chang, Chang, & Chen, 2022; Daspit et al., 2023; Kamaliah et al., 2024; Larsen, 2022; Van Gelderen, 2023). To explain this, it can be said that implementing the digital competency program and technology education for students increases their attitudes, skills, and knowledge, leading to an increase in their self-organization spirit (planning and entrepreneurship).

In response to the second research question, the results of the effects of between-subjects test for comparing the components of entrepreneurial mindset in individuals in the experimental and control groups in the post-test phase demonstrate that there was significant for creativity, motivation for progress, risk-taking, future orientation, internal locus of control, and self-esteem. Considering the higher mean scores of the experimental group in the post-test phase and the effect size of implementing the digital competency program on the components of entrepreneurial mindset, it can be inferred that the effect of implementing the digital competency program on each of the components of students' entrepreneurial mindset was different. The results of this study are consistent with the research(Chang et al., 2022; Crosina et al., 2024; Daspit et al., 2023). It can be said that the implementation of the digital competency program increases self-confidence and risk-taking mindset, innovation, creativity, and commitment to decisions and self-reliance in students.

In response to the third research question, the results of the effects of between-subjects test for comparing the components of lifelong learning in individuals in the experimental and control groups in the post-test phase demonstrate that there was a significant difference for each component of lifelong learning. Considering the higher mean scores of the experimental group in the post-test phase and the effect. In response to the fourth research question, the results of the analysis of covariance test for comparing the scores of lifelong learning in students in the experimental and control groups in the post-test phase showed that the there was a significant difference between two groups. The effect size of implementing the digital competency program on students' lifelong learning was 61.6%. Based on these results and the higher mean scores of the experimental group in the post-test phase, it can be concluded that the implementation of the digital competency program had a positive and significant effect on students' lifelong learning. These findings are consistent with the previous research (Uzunboylu & Selcuk, 2016). It can be said that the implementation of this program increases students' self-awareness and awareness of others, allowing them to integrate digital technology learning into their daily activities. It can be concluded that the effect of implementing the digital competency program on each of the components of students' lifelong learning was different. These results are consistent with the study by Khoshnoud et al. (2022). It can be said that the implementation of the digital competency program can increase students' continuous, voluntary, and self-motivated pursuit of knowledge and help improve their quality of life and sense of self-worth, considering the ideas and goals that inspire students.

Research Limitations

Limited availability of previous articles and research studies, and in some cases, the lack of practical applicability of research results, are among the mentioned limitations.

Not following up with educational authorities, lack of adequate resources and facilities suitable for education, and insufficient workspace for vocational readiness are other constraints for achieving the objectives of this project.

Suggestions

Based on the results of the first and second research questions, it is recommended to design a competency-based curriculum instead of a subject-centered curriculum. This curriculum should be based on identified competencies and engage students practically to prepare them for the job market.

Considering the results of the third and fourth research questions, designing learning opportunities based on constructive learning psychology principles is essential. Since competency encompasses knowledge, abilities, and skills, traditional approaches to fostering competency might not be effective enough. Therefore, employing constructivist and participatory learning approaches can be more effective in preparing students for the job market.

In line with the findings of the first research question, familiarizing different individuals with this methodology can be significantly effective in creating an appropriate and supportive structure. Establishing such an approach can provide students with practical skills for entering the job market.

Reflecting on the results of the first research question, there should be a package of entrepreneurship education in schools to strongly support the entrepreneurship education process. Having an entrepreneurial outlook on various professions eliminates the standardization of individuals and assigns them different burdens. In this case, concerns about the lack of suitable employment for them in the not-so-distant future will diminish, giving them new hope.

Considering the selected sample in this study, which consisted of sixth-grade female students, all evaluations were based on data extracted from these students. It is suggested that researchers evaluate the data in a larger sample size, given the significance and importance of the results in improving the processes of enhancing students' entrepreneurial mindset.

Researchers are advised to use other methods, algorithms, and optimization techniques to calculate students' entrepreneurial mindset.

Given the importance of the research topic and the limitations of the current study, it is suggested that future studies not only utilize the results of the current research but also identify comprehensive criteria for assessment. These criteria should be prioritized for investigation in future studies

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