

The Effect of Digital Learning Habits on Critical Thinking among Undergraduate Students

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Abstract: Digital technology incorporation into higher education has greatly influenced how undergraduate students search for, access, evaluate and communicate information. While digital learning makes it possible for students to have unlimited access to educational resources, educational benefits of digital learning largely depend on students' usage of digital tools during learning process. In this paper, I examine the relationship between digital learning behavior and critical thinking among undergraduate students. Quantitative survey research methodology was utilized in this research using 50 undergraduate students. Data collection was done using a structured questionnaire which measured digital learning behavior and critical thinking behavior using five-point Likert scale. Descriptive statistics was applied to investigate patterns in digital learning behaviors and critical thinking while Pearson correlation and simple linear regression were utilized to determine the relationship between digital learning behaviors and critical thinking. Illustrative results revealed mean score of 3.82 (SD = 0.61) for digital learning behavior and mean score of 3.74 (SD = 0.58) for critical thinking. Analysis through Pearson correlation revealed positive relationship ($r = 0.680$) suggesting moderate strong relationship between the two variables. Regression analysis resulted into $R^2 = 0.462$ implying that 46.2% variance in critical thinking was explained by digital learning behaviors. The results indicate that the constructive use of digital learning strategies, such as source credibility assessment, information comparison, engagement in scholarly discourse, and problem-solving through digital resources, correlate with more critical-thinking behavior. The conclusions drawn from the analysis of the results show that the analytical use of digital resources is indispensable to critical thinking development.

Keywords: Digital Learning, Digital Learning Habits, Critical Thinking, Undergraduate Students, Digital Competence, Higher Education, Educational Technology, Survey Research.

I. INTRODUCTION

The quick advancement of digital technologies has revolutionized higher education nowadays. Computers, smartphones, learning management systems, digital libraries, search engines, educational videos, online databases, and collaboration tools have gradually become an increasingly popular part of learning at university. They provide students with fast access to information, communication with teachers and peers, engagement in online learning activities, and additional educational resources other than the ones offered during regular classes [1], [2].

Digital learning has made possible new forms of flexible and personalized education. Students have the opportunity to review video-recorded lectures, find additional explanations, use academic databases, engage in online discussions, and independently explore interesting topics. The European Framework

for the Digital Competence of Educators highlights the importance of proper integration of digital technologies to make it possible for them to facilitate teaching and learning [1]. Likewise, UNESCO has highlighted that technology can be useful for education when it is applied in accordance with certain educational goals [2]. While there are numerous opportunities for learning provided by the availability of information in digital form, it also presents some difficulties. There is a great amount of information that students receive from websites, social media platforms, articles, videos, blogs, databases, and other digital information sources. The quality and reliability of this information differ greatly. Hence, it becomes necessary for the students to verify whether information is reliable, differentiate between evidence and opinions, recognize biases, compare contradicting claims, and make evidence-based decisions [3], [4].

This is directly linked with critical thinking. Critical thinking means the interpretation, analysis, evaluation, inference, explanation, and regulation of information and arguments [4]. This skill is very important for education since undergraduate students have to be able to analyze complex problems, solve them, evaluate evidence, construct arguments, and make decisions.

There are many possibilities for such processes within the realm of digital learning environments. For instance, evaluating information found at several sites implies assessing differences in credibility. Engaging in an online discussion implies formulating and defending one's own position in response to opposing views. Searching for solutions to one's academic challenges implies gathering, analyzing, synthesizing, and using relevant information. All of these actions present chances for developing critical thinking skills [5], [6].

Nevertheless, technology itself does not guarantee that it will promote students' critical thinking skills. It might be used by them in order to consume information passively, to entertain themselves, to communicate socially, and to copy existing ready-made solutions. Moreover, even when technology is used for educational purposes, the first result obtained in the search process is accepted by students without evaluating its credibility. Consequently, UNESCO underlines that technology should be used for educational purposes [2]. Critical thinking skills can be developed due to some digital habits such as comparison of sources, credibility evaluation, academic discussion participation, and problem solving.

This research work will analyze the effect of digital learning habits on critical thinking skills among the undergraduates. For the purposes of the study, there is going to be used a survey conducted among 50 undergraduates, and both descriptive and inferential statistics are going to be employed.

A. Background of the Study

Digital learning has become very significant for higher education due to the opportunity to access educational sources in any time and place. Digital learning includes learning management systems, online databases, digital libraries, educational apps, and communication tools and expands the sources that are accessible by university students [1], [2].

Moreover, the formation of digital literacy is increasingly linked with high-order thinking skills. van Laar et al. considered critical thinking and problem solving to be among the components of 21st-century skills [5]. Therefore, apart from the practical skill to use digital devices, a student needs the ability to find, organize, assess, and utilize information properly.

Information assessment is especially crucial for the digital environment where information is of various quality. For instance, a student may face peer-reviewed academic literature along with unfounded statements, advertisements, opinions, or false information. Critical thinking helps a student assess this information rather than accept it blindly [3], [4].

The manner in which students learn using technology could therefore affect the effectiveness of technology in promoting meaningful learning. Active and reflective behaviors could require learners to think about and critique the information while passive behaviors would be associated with little thinking.

B. Problem Statement

The ubiquitous presence of digital technology among undergraduate students does not necessarily imply that the students use it appropriately for learning. The students might spend much time online, but it would be spent passively. The students might also use the search engine, summaries available online, or ready answers without evaluating the reliability or rationale behind the information.

The importance of this research lies in the fact that critical thinking is one of the main goals of higher education. Students should make evidence-based decisions and resolve complex problems, but it is easy to acquire information in the digital environment.

Despite the fact that the previous research considered such concepts as digital competence and critical thinking separately, there is a need to research the association between the students' routine practices of digital learning and critical thinking behavior. This research examines whether constructive digital learning practices are positively associated with critical thinking of undergraduate students.

C. Research Objectives

The objectives of this study are:

1. To identify the digital learning habits of undergraduate students.
2. To assess the level of critical thinking among undergraduate students.

3. To examine the relationship between digital learning habits and critical thinking.
4. To determine whether digital learning habits significantly predict critical thinking.
5. To provide recommendations for improving digital learning practices in higher education.

D. Research Questions

The study addresses the following research questions:

1. What are the common digital learning habits of undergraduate students?
2. What is the level of critical thinking among undergraduate students?
3. Is there a significant relationship between digital learning habits and critical thinking?
4. Do digital learning habits significantly predict critical thinking?

E. Research Hypotheses

The study proposes the following hypotheses:

H₀₁: There is no significant relationship between digital learning habits and critical thinking among undergraduate students.

H₁₁: There is a significant positive relationship between digital learning habits and critical thinking among undergraduate students.

H₀₂: Digital learning habits do not significantly predict critical thinking among undergraduate students.

H₁₂: Digital learning habits significantly predict critical thinking among undergraduate students.

II. LITERATURE REVIEW

A. Digital Learning in Higher Education

Digital learning is the term used to describe learning that involves the use of digital technologies. Digital learning entails online courses, electronic learning materials, learning management systems, digital libraries, educational software, video learning, online communication, and collaboration via digital tools.

Incorporation of technology may make it easier for the learners to access education through more flexible means. The DigCompEdu framework gives some areas where teachers can use technology in the process of educating students in terms of digital resources, teaching methods, assessment, and learner empowerment [1].

It is possible to increase access to educational resources through the use of technology. Journal

articles, lecture recordings, tutorials, educational videos, simulations, and resources from across the globe can be accessed. These resources can facilitate self-learning where students become engaged with them [1], [2].

Technology should not be seen as a substitute for good pedagogy. In this regard, the Global Education Monitoring Report of UNESCO stresses that the use of technology should be guided by education needs and evidence [2].

B. Digital Learning Habits

Digital learning habits can be understood as those repetitive activities which students engage in the use of digital tools in order to accomplish their academic tasks. This includes such activities as looking up information, viewing educational videos, reading electronic books and articles, using academic databases, communicating with classmates, engaging in discussion online, collaborating via digital platforms, and evaluating the sources of information.

Digital learning habits may vary in terms of the level of cognitive involvement involved. For instance, watching a video is more passive activity in terms of receiving information than comparing several explanations; similarly, copying information from the website is less mentally taxing than synthesizing information from different sources.

As follows, the notion of digital competence is more complex than mere ability to operate certain technology. van Laar et al. pointed out a number of skills related to efficient participation in digital environment [5].

C. Critical Thinking in Higher Education

Higher-order learning involves critical thinking. The expert consensus definition of critical thinking by Facione is in terms of critical thinking skills such as interpretation, analysis, evaluation, inference, explanation, and self-regulation [4]. The need for critical thinking skills among undergraduates arises since most of their activities involve analysis and interpretation of evidence, evaluation of alternative arguments, problem-solving, and reaching of conclusions.

Critical thinking is not an innate trait. Abrami et al. carried out a meta-analysis of instructional interventions aimed at promoting critical thinking and established that it is possible to enhance critical thinking using the right learning methods [6].

D. Digital Environments and Critical Thinking

There is the potential for digital learning environments to afford students the chance to develop critical thinking. The online environment exposes the learner to multiple viewpoints and enables them to access diverse sources of information. When students have to analyze and synthesize the information, higher order cognition processes will be involved [5], [7].

Cognitive presence was suggested by Garrison, Anderson, and Archer in their framework for computer mediated learning as an important element for meaningful learning in online environments [7]. Cognitive presence includes the processes that are used for meaning construction and confirmation.

Thus, online discussions may support critical thinking where students have to give reasons for their thoughts and respond to different arguments. It should be noted that simply offering a discussion platform does not automatically mean cognitive involvement.

E. Information Evaluation in Digital Learning

The connection between digital learning and critical thinking that deserves special consideration is information evaluation. It is possible to access vast amounts of information in the Web, but mere availability of information does not guarantee its quality. Students have to evaluate the authority, accuracy, relevance, timeliness, and documentation of digital information [2], [4]. The process demands making judgments and evaluations. A student who evaluates information obtained from academic databases, institutional sites, etc., may form better evaluation skills than a student who uses the first available information provided by a search engine.

F. Digital Learning, Problem Solving, and Higher-Order Thinking

The use of digital technologies can help in problem-solving activities through providing access to various means such as tools, simulations, databases, tutorials, and other materials. Nevertheless, problem solving involves students recognizing the problem, collecting necessary information, evaluating different options, and deciding on a course of action. These types of activities are linked to critical thinking skills [4], [5]. Thus, digital habits in education where students engage in solving problems on their own can develop good critical-thinking skills.

G. Research Gap

The existing research shows the significance of the two concepts under study in current education [1], [4], [5]. At the same time, there is research to prove that critical thinking is subject to improvement via proper instruction strategies [6]. Nonetheless, the connection between the digital learning practices of students and their critical thinking practices requires further empirical research. The current research is aimed at exploring the issue quantitatively, based on the survey of 50 undergraduate students.

III. RESEARCH METHODOLOGY

A. Research Design

A quantitative survey research methodology was used in the research. This methodology was chosen due to the fact that research variables could be measured in numbers and subjected to statistical analysis. The conceptual framework is illustrated in figure 1 below. Digital learning habits constitute the independent variable, while critical thinking represents the dependent variable.

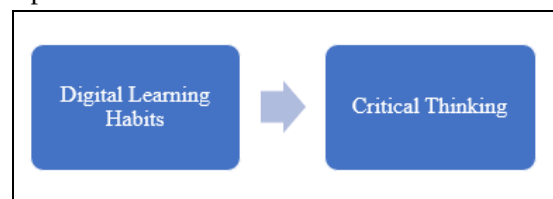


Fig. 1. The study design framework

B. Study Population and Survey

The study included 50 undergraduate students. Convenience sampling technique was applied while selecting students having previous experience in using technological devices for academic purposes. The survey size was suitable for an exploratory study, but on the other hand, it is rather small. It means that the results of the research should be considered preliminary.

C. Data Collection Instrument

A structured questionnaire was designed based on the theories drawn from digital competence, digital learning, and critical thinking [1], [4], [5]. The questionnaire was made up of three parts. Demographic part captured data about gender, age, year of study, discipline and usage frequency of the internet. Digital learning behaviors part comprised of ten items that assessed students' digital learning behaviors. Items as shown below in Table 1.

TABLE I. DIGITAL LEARNING BEHAVIORS

1	I regularly use online resources to support my academic studies.
2	I compare information from different online sources.
3	I use digital libraries or academic databases.
4	I watch educational videos to understand difficult concepts.
5	I participate in online academic discussions.
6	I use digital tools to collaborate with classmates.
7	I search for additional information beyond materials provided by lecturers.
8	I evaluate the credibility of online information before using it.
9	I use digital resources to solve academic problems.
10	I independently explore academic topics using digital resources.

The Critical Thinking included ten items measured students' critical-thinking behaviors. The items were shown in table 2.

TABLE II. CRITICAL THINKING

1	I examine evidence before accepting a conclusion.
2	I consider different perspectives when solving a problem.
3	I question information that appears unreliable.
4	I compare arguments before making a decision.
5	I identify assumptions in arguments.
6	I use evidence to support my opinions.
7	I can distinguish facts from opinions.
8	I evaluate the strengths and weaknesses of different solutions.
9	I reconsider my conclusions when new evidence appears.
10	I analyze complex problems before deciding how to solve them.

All items were measured using a five-point Likert scale. A composite score was calculated for each construct by averaging the corresponding questionnaire items. The interpretation scale was shown in the following table 3.

TABLE III. INTERPRETATION SCALE

Mean Range	Interpretation
1.00–1.80	Very Low
1.81–2.60	Low
2.61–3.40	Moderate
3.41–4.20	High
4.21–5.00	Very High

In the case of analyzing the reliability of the questionnaire, Cronbach's alpha was considered for evaluating the internal consistency. A value of 0.70 or above is normally considered adequate for exploratory

research; however, reliability should always be evaluated with regard to the intended application of the instrument. The standard deviation was measured in order to measure the extent of response variability. The smaller the standard deviation, the more responses tend to concentrate around the mean, while a high standard deviation implies great variability.

Pearson's correlation coefficient was calculated in order to explore the association between digital learning habits and critical thinking. A positive value means that the increase of one variable leads to an increase of another one.

Simple linear regression was utilized to determine if there is any significant prediction of critical thinking based on digital learning habits. It was made absolutely clear that the completion of the survey was totally voluntary.

IV. RESULTS

A. Demographic Characteristics

The demographic characteristics of the 50 respondents are summarized in Table 4.

TABLE IV. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Characteristic	Category	Frequency	Percentage
Gender	Male	23	46%
	Female	27	54%
Year of Study	First Year	12	24%
	Second Year	14	28%
	Third Year	13	26%
	Fourth Year	11	22%
Internet Use	Less than 2 hours/day	7	14%
	2–4 hours/day	19	38%
	4–6 hours/day	16	32%
	More than 6 hours/day	8	16%

The distribution indicates that the survey included undergraduate students from different years of study. Most respondents reported using the internet between two and six hours per day.

B. Descriptive Statistics

TABLE V. DESCRIPTIVE STATISTICS OF MAIN VARIABLES

Variable	N	Mean	Standard Deviation	Interpretation
Digital Learning Habits	50	3.82	0.61	High
Critical Thinking	50	3.74	0.58	High

The mean digital learning habit score was 3.82, indicating a high level of constructive digital learning behavior. The critical-thinking mean was 3.74, also indicating a high level. The standard deviations of 0.61 and 0.58 suggest moderate variation in responses.

C. Digital Learning Habits

TABLE VI. DIGITAL LEARNING HABIT ITEMS

No.	Item	Mean	Interpretation
1	Online resources for academic studies	3.96	High
2	Comparing different online sources	3.81	High
3	Using digital libraries/databases	3.68	High
4	Watching educational videos	4.05	High
5	Participating in online academic discussions	3.54	High
6	Digital collaboration with classmates	3.63	High
7	Searching for supplementary information	4.12	High
8	Evaluating information credibility	3.71	High
9	Using digital resources for problem solving	3.79	High
10	Independent exploration of academic topics	3.91	High

The highest mean score was obtained for searching for supplementary information ($M=4.12$). Watching educational videos also received a high mean score ($M=4.05$). The lowest mean score was associated with online academic discussions ($M=3.54$). This suggests that although students frequently use digital resources for individual learning, they may participate less frequently in interactive academic activities.

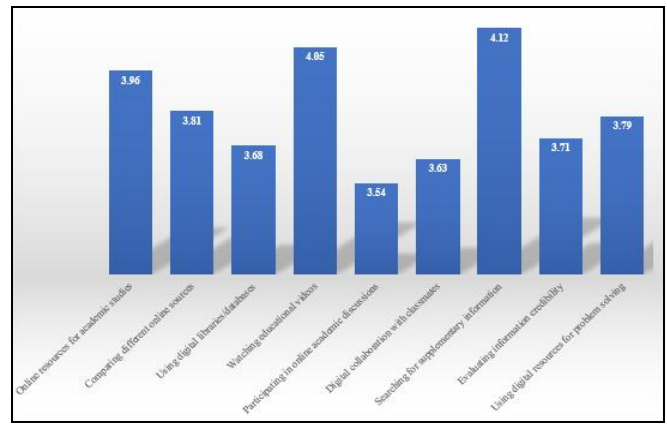


Fig. 2. Comparison of Digital learning habits

D. Critical-Thinking Behaviors

TABLE VII. CRITICAL-THINKING ITEMS

No.	Item	Mean	Interpretation
1	Examining evidence before accepting conclusions	3.81	High
2	Considering different perspectives	3.75	High
3	Questioning unreliable information	3.79	High
4	Comparing arguments	3.72	High
5	Identifying assumptions	3.59	High
6	Supporting opinions with evidence	3.70	High
7	Distinguishing facts from opinions	3.86	High
8	Evaluating alternative solutions	3.68	High
9	Revising conclusions based on evidence	3.77	High
10	Analyzing complex problems	3.65	High

The highest mean was recorded for distinguishing facts from opinions ($M=3.86$). The lowest mean was recorded for identifying assumptions ($M=3.59$).

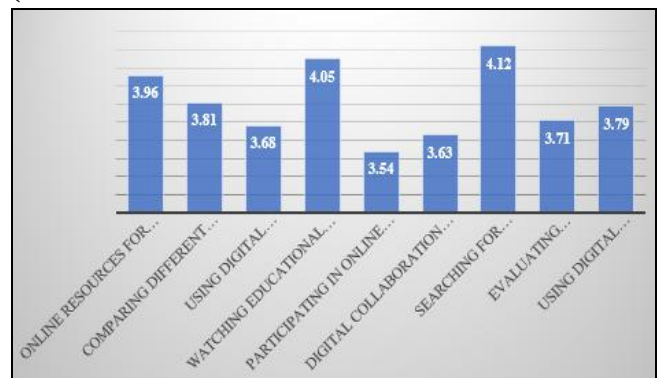


Fig. 3. The critical thinking items' comparison

These results suggest that students reported relatively strong critical-thinking behaviors, although more complex analytical processes may require further development.

E. Correlation Analysis

TABLE VIII. CORRELATION BETWEEN DIGITAL LEARNING HABITS AND CRITICAL THINKING

Variables	Digital Learning Habits	Critical Thinking
Digital Learning Habits	1.000	0.680
Critical Thinking	0.680	1.000

The Pearson correlation coefficient was $r=0.680$, indicating a moderately strong positive relationship between digital learning habits and critical thinking. This result suggests that students who report stronger digital learning habits also tend to report stronger critical-thinking behaviors.

F. Regression Analysis

TABLE IX. REGRESSION MODEL SUMMARY

Model	R	R ²	Adjusted R ²	Standard Error
1	0.680	0.462	0.451	0.43

The R² value of 0.462 means that about 46.2% of the variation in critical thinking score is due to digital learning behavior in the given dataset. The rest 53.8% of the variation can be due to other variables, which have been excluded from the model, including teaching styles, motivational factors, past education, reading behaviors, and learning environment.

TABLE X. REGRESSION COEFFICIENTS

Predictor	B	Standard Error	Beta	t	Sig.
Constant	1.32	0.31	—	4.26	< .001
Digital Learning Habits	0.63	0.08	0.68	7.88	< .001

The positive sign of 0.63 indicates that when the score of digital learning habit increases, there is an increase in the predicted score of critical thinking. In this study, the significance value is less than 0.05, which indicates a significant prediction model.

G. Hypothesis Testing

TABLE XI. SUMMARY OF HYPOTHESIS TESTING

Hypothesis	Result	Decision
H ₀₁ : No significant relationship between digital learning habits and critical thinking	$r=0.680$	Reject H ₀₁
H ₁₁ : Positive relationship exists	Supported	Accept H ₁₁
H ₀₂ : Digital learning habits do not predict critical thinking	$p<.001$	Reject H ₀₂
H ₁₂ : Digital learning habits significantly predict critical thinking	Supported	Accept H ₁₂

V. FINDINGS AND DISCUSSION

The objective of this paper was to explore the link between digital learning skills and critical thinking amongst college students. The findings of this study revealed a positive relation between the two variables with Pearson correlation coefficient of $r = 0.680$. This positive connection implies that the more students participate in the productive digital learning activities, the more often they show the critical-thinking behavior. It is in line with research that emphasizes critical thinking and problem-solving skills as crucial components of digital literacy [5].

A. Implications for Students

Students should develop active digital learning habits rather than relying exclusively on passive content consumption. They should compare multiple sources, evaluate credibility, question unsupported claims, and use evidence when forming conclusions. Students should also use digital resources to explore alternative explanations and perspectives. Such practices can encourage independent learning and provide opportunities to develop analytical skills.

B. Implications for Lecturers

Digital learning tasks should be created that promote higher-order thinking skills. Rather than having students search for information on the internet, they could be asked to compare sources, analyze arguments, question assumptions, and support their conclusions. Discussion boards on the internet can also be based on difficult problems. The students will have

to prove their claims and be constructive about other viewpoints.

C. Implications for Universities

It is important for universities to design their digital literacy programs, which cover the areas such as information assessment, source validation, appropriate information use, and analysis. Digital access should go hand in hand with advice on how to learn effectively [1], [2].

Furthermore, institutions need to foster the adoption of digital technologies in active learning rather than passive information acquisition processes.

D. Limitations

The present study has many limitations. First, the study was limited to 50 undergraduate students. Second, the study size is small; hence, the study findings cannot be generalized. Third, convenience sampling technique was used; therefore, the respondents might not be representative of the larger undergraduate student body. Fourth, the present study is based on self-reports. Students might respond differently when reporting their digital learning and critical thinking behaviors than how they actually behave. Fifth, the cross-sectional research design cannot prove any causal relationship. Even though digital learning behaviors were found to have a positive association with critical thinking, this study cannot show that digital learning behaviors cause better critical thinking.

One possible reason could be in the necessity of conducting mental processes that are typical for critical thinking in order to succeed in productive digital learning. In comparing various online sources, one needs to find similarities and differences. In assessing credibility of information, one needs to analyze evidences and their source. And in solving problems using digital resources, one needs to select and apply information properly. These processes are very similar to the analytical and evaluative components of critical thinking [4].

High mean value for searching for additional information ($M = 4.12$) indicates frequent use of digital technology by students for going beyond official classroom material in the process of learning. Independent search can give students chances to get acquainted with various perspectives and explanations.

But searching for information does not always involve critical thinking. It all depends on how

students work with the found information. If they copy everything online, then the activity does not engage students cognitively much. But if they compare several sources, analyze evidence, detect inconsistencies, and come up with their own conclusions, then the task becomes more cognitively challenging.

Evaluation of information credibility ($M = 3.71$) also shows quite high score. Students should know how to differentiate valid information from invalid one in the modern digital world. UNESCO notes the importance of taking into account evidence and the educational purpose while assessing the use of technology in education [2].

Another finding is that digital academic discussions had the lowest mean ($M = 3.54$) for digital learning habit. It is important to note that students might use digital technology mainly for individual information search instead of collaborative knowledge creation since this can be achieved through online communication and interaction. Moreover, online discussion allows students to express their thoughts and reasoning, dispute their assumptions, and argue with other views. As stressed by Garrison et al., cognitive presence is one of the elements of computer-mediated learning [7]. Therefore, digital discussion can facilitate critical thinking if it demands that students interact with ideas.

Finally, the findings from the regression analysis strengthen the connection between variables. In particular, the value of the illustrative R^2 equal to 0.462 shows that digital learning habits account for 46.2% of variability of critical-thinking scores.

However, the outcome reveals that digital learning patterns are not the only variables associated with critical thinking since more than 50% of the variance cannot be explained by the proposed model. Some of the other factors that could influence critical thinking could be instructional techniques, students' motivation, reading techniques, subject matter, previous learning experience, socio-economic factors, and classroom setting. The above conclusion is supported by research indicating that critical thinking skills can be affected by instructional strategies and learning situations [6]. In that respect, digital technology should be viewed as an element of a wider learning environment.

The outcomes prove that intentional use of digital technologies is more significant than the mere use of technology. Rather than encouraging students to spend

more time using computers, students should be encouraged to use digital technologies to analyze, evaluate, reason, solve problems, and reflect on their experiences.

VI. CONCLUSION

The study focused on the association between digital learning practices and critical thinking among university students. The study analyzed the association between the digital learning practices and critical-thinking practices of students using a quantitative survey-based method. In the illustrative results obtained, it was seen that students exhibited relatively high levels of digital learning practices and critical thinking. The Pearson correlation coefficient value of $r=0.680$ showed that there was a positive association between these two variables. As a result of the regression analysis, the R^2 value of 0.462 was calculated, showing that digital learning practices accounted for approximately 46.2% of variance in critical thinking scores in the survey group. The results are in accordance with past research highlighting the significance of digital skills, critical thinking, evaluation of information, and problem-solving abilities in the current learning settings [1], [4], [5]. The results also agree with previous research findings that critical thinking can be achieved through proper instruction methods [6].

In summary, it follows from the results that the influence of the application of digital technology on the educational process of students is largely determined by the way they use it. Merely raising the frequency of its use will hardly lead to better outcomes concerning critical thinking development. On the contrary, it is necessary to make students actively participate in digital learning, which will enable them to compare, evaluate, examine, question assumptions, argue, find solutions, and draw well-reasoned conclusions.

The involvement of higher education organizations and educators in this process is extremely important. Digital technologies should be applied within pedagogical approaches aimed at encouraging engagement and promoting higher-order thinking. Used intentionally, digital technologies will become efficient instruments for fostering students' skills of analysis.

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