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Navigating Students' Growth Mindset and Connectivist Learning Experience With Dynamic Technologies

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Research Article

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Abstract

Technology is one of the twenty-first century assets provided to our world by those devoted peoples. However, it has not yet been widely utilized in education like other fields. Bearing this in mind, the current study investigated student teachers' digital growth mindset, collaboration skills and their application of dynamic technologies in academic learning. For this purpose, 265 college student teachers from different departments were recruited with multistage sampling methods (Eg., availability sampling, proportional and quota sampling to incorporate demographic factors- urban, rural, male, female, age and department type). Mixed research approach known as Quan+qual was employed during the study. Survey tool was prepared and pilot tested with first year students who were from other college. Results indicate that there was significant positive association among students' digital growth mindset, collaboration skills and use of dynamic technologies in education. It was also detected for growth mindset and collaboration skills as predictors for dynamic technology practices for academic learning. Student teachers have high digital mindset and dynamic digital practices, but low Connectivist experiences/collaboration skills. They reported that they have high mastery mindset and can use digital technologies for learning, but modest collaboration skills. This was also supported by qualitative data. Besides, one way ANOVA test indicated there was no significant difference by gender. However, both sexes differed on collaboration skills. This has implications for teacher training institutions, students, instructors and administrators, education directorates and future researchers.

1. Introduction

Technology has become the center of world's gravity such as in communication, scientific innovations, business, health, welfare and security, space discoveries, engineering and education systems etc. As a worldwide, literatures indicate that the use of information communication technology extensively enhanced in the areas of business and banking, national security, engineering, tourism, sporting and scientific innovations etc., yet it has not been widely applied in academic practices.

Regardless of inconsistencies exist; however, students in different part of the world begun to supplement their academic learning with devices such as desktops, laptops, tablets, handheld mobiles, IPhone etc. Digital technology can have varieties ranging from computers, mass media and handheld mobiles which may entail computer, Laptop, LCD, digital photocopy machine, digital Audio and Video devices, digital camera, scanner, DVD player and multimedia projector. The intension to use such technological devices is termed as digital growth mindset (Kwak et al.,2022 ; Limeri, et al., 2020; Bashir and Jimmy, 2023).

Particularly computers, tablets and smart phone technologies have become the gravity of educational practices for they easily help students in collecting, storing, editing, retrieving, and transferring various learning resources and information. These dynamic technologies provide students with various platforms such as with Youtube, telegram, Facebook, VAR, ChatGPT, IMO, Tiktok, Messenger, Twitter,

Instagram, IWB and WhatsApp etc.(Jamir and Pongen, 2021; Gower et al., 2023; Bekele and Dereje, 2024 and Landrum, 2020; Hortelanoa et al., 2021 and Nsemo et al., 2022).

If academic learnings are scientifically designed by teachers and curricularists, these tools have ample opportunities for learning practices especially during pandemic phenomenon. On top of this, students may not be satisfied with the traditional transmission approach of the lecture approach and knowledge transmission; they would prefer to interact with the instructor and to be in constant communication with their peers, and learn best in highly customizable environments in which knowledge can be created and shared collaboratively (Bashir and Jimmy, 2023; Ibrahim and Aldawsari, 2023).

In this twenty first century world, professional technological experience has become compulsory. To say it in another way, student teachers are expected not only to learn their academic courses with different technologies but also expected to develop their professional agency in various approaches: the CK, TK, TCK and TPACK as they join higher institutions (Ojok, 2018; Apuke and Iyendo, 2018, Arek-Bawa and Reddy, 2025). The authorities explain that as teachers' digital literacy increases, their ability in navigating, creating and applying different technologies in learning improves.

As using technology needs information access, to connect with experts for different information matters. Some authors connote this with connectivism theory (Chu and Chu, 2009; Alam, 2023; Anderson and Groulx, 2011; Landrum, 2020) whereas others enunciate such technological practices as collaborative skill(García-Valcárcel and Mena, 2016; Jördens et al., 2024). They contended that student collaborative experiences cultivate not only technology skills but also their learning autonomy, learning style and students' intercultural awareness and social interdependence. This in turn connects students to different people with different learning and teaching experiences as students can create virtual communities that connect them in real time with learners and teachers anywhere around the world. They can receive feedback from their teachers and share questions and concerns about their lessons. By listening to and reading about others' opinions and feedback, students refine their thinking, reaching higher levels of comprehension and deeper understanding. Therefore, students' collaboration experience on various technological tools have direct relationship with connectivism theory of learning, and so enhance mental readiness- growth mindset practices. Digital growth mindset, in this study, can be conceived as a belief that a college student holds about his/her most basic qualities and abilities in using dynamic technologies and ICT tools. This mindset can be growing one or strongly positive belief.

Global research practices indicate that students obsessed the use of new technological gadgets, but rarely for learning. A plethora of studies concerned with students' digital learning experiences. However, little had known about students' psychological factors like growth mindset effects on them (Limeri et al.,2020). Aldosari (2025) recently studied the digital platform preferences of Saudi Arabian university students, and came up with that most students regularly engaged in Zoom use other than existing dynamic technologies. However, this study couldn't differentiate which gender more exercises different dynamic digital tools.

Also Yavuzalp and Bahcivan(2021) has depicted about the university students' readiness for e-learning, self-regulation skills, satisfaction and academic achievement using a sample of 749 university students in Turkey. Their study disclosed that readiness for e-learning indicated positive association and significantly predicted students' self-regulation skills, satisfaction and their academic achievement in distance learning context. Also self-regulation skills significantly contributed to student satisfaction and their satisfaction well predicted their academic achievement (p.16). Similarly, Jan (2015) conducted a study with 103 graduate students taking online courses at a university in USA. The researcher measured academic self-efficacy, computer self-efficacy, prior experience with online learning and student satisfaction. The results of the study found a positive and significant relationship between computer self-efficacy and prior experience with online learning, and between academic self-efficacy and prior experience with online learning, and between academic self-efficacy and student satisfaction. The above studies recommended the need for further study in the area of technology use.

Sun and Zhang(2024) have studied student characters in using technology for learning English language. They have found positive associations among variables of engagement, learning behaviours and promising predictions in technology practices. Ogheneakoke et al(2018) have investigated internet access and usage for academic performance in Social Sciences. The study found significant relationship between internet usage for academic work and students' academic performance. Adams et al (2022) investigated pre-service teachers' perspectives on the use of ICT in Berekum College of Education. The study examined the types of technologies pre-service teachers' use as well as their purpose for using those technologies. They found that college students have sufficient access to technology on their campus, and used for assignment writing, for presentations, for research, for emailing and for chatting. However, this study has used small sample size available in college. Directly or indirectly such studies implicate readiness for using digital technology in education among world students.

However, most studies including the above ones have not yet dealt with psychological constructs known as digital learning growth mindset and collaborative skills in dynamic technology practices among learners. It is expected that college students may arrive in HE with their past school experiences and new growth expectations that shape their perceptions of successful learning(Kuo et al, 2014; Yu, 2018; Jördens et al., 2024). This makes a compelling case to consider student growth mindset in the context of technological practices. Thus, this study may be the pioneering one implicating the linkage between technology mindset of higher education students.

Moreover, technology integration and practices have not received much attention in Ethiopia. To the knowledge of the researcher, there is no sufficient local studies with dynamic technologies application in teaching-learning in relation to students' growth mindset conception and collaborative agency practices. In Ethiopia Endale et al.(2022) implicated teachers digital technology competence need to be improved via in-service training because they found relationships and predictive powers of technological pedagogical integration among secondary school teachers in Wolaita Zone. Bekele and Dereje(2024), however, depicted university students are not utilizing LMS in Hawassa University for academic purpose.

Therefore, the current researcher strongly believe that students of various departments' digital mastery mindset, collaboration skills and use of dynamic technologies should be identified by research. Growth mindset towards technology use unlock students' further learning experience. Even if students have different technological skills, they may spoil many opportunities of learning from current knowledge. That is, students must possess strong mindset for academic learning even in unfavourable conditions. Otherwise, their teachers become reluctant to expose them to digital learning practices. Eventhough many studies considered student collaborative learning skills, scholars barely dealt with students' digital mindset. Also there is no any study concerning technology practices studied in Fitche College of Teacher Education where this study was conducted. Hence, the following research questions are formulated for this study:

1. How is the relationship between digital growth mindset, collaboration skill and dynamic technology practice among preservice teachers?
2. To what extent students' digital growth mindset and collaboration experience contribute to their dynamic technology practices for academic learning? If so, what are the students' views?
3. Does a statistically significant difference exist between female and male students on digital growth mindset, collaboration skill and technology practices?

2. Methodology

The current study approach is based on the Quan+qual research approach(Dornyei, 2007:169). Quantitative procedures such as frequencies, means, standard deviations, variances and percentage can be integrated and lead to other inferential statistics such as correlations and regressions in survey studies. Therefore, quantitative is the principal approach of the current study. In order to capture some thoughts and opinions among student teachers, the qualitative was nested in this method.

Besides, population for this study was determined. The current study was conducted in Fitche College of Teacher Education-where the current researcher works. In order to carry out the study, the researcher plan to collect datum from preservice students who enrolled in different departments at FCTE by 2017/2025. Consequently 528 diploma program preservice teachers were identified as a target population. When the study participants classified into fields of study, there are 266 social science learners(English language, Afan Oromo language, Safuu or Custom, Afan Amara language) and 262 are natural science(Environmental Science, Mathematics, Physical education and Health) fields of study. Before the actual sample started, the researcher has been granted all approvals by the FCTE research team office and AC of the college.

A Proportional Multistage Sampling(PMS) method-with approximations where necessary, has been utilized to obtain the study data from those preservice teachers. Primarily, 50% of the diploma teachers has been targeted for plan from the total of 528 students because of time routines and budget constraints. According to some authors 20% of the sample for study is supported in social science survey studies where there is large population for a study(Airsia et al., 2003 and Gall et al., 2007;

Johnson and Christensen, 2014; Creswell, 2014; Tabachnick and Fidell, 2007; Thornhill, 2011; Morgan, 2005; Darlington and Hayes, 2017; Hair et al., 2022 and Kline, 2016). Assuming 30 extra participants for data cleaning procedures ahead; therefore, 265 participants have been recruited. Accordingly keeping the proportion for gender, 69 females and 65 males were chosen from the social science that makes 134 participants. Likewise, 63 females and 68 males that makes 131 students were selected from the Natural Science fields. However, the random sampling based on Snowball technique is applied in each section to keep these proportions. Finally a sample of 265 students obtained based on their efficiency in response rate supported by the 30 extra papers.

The researcher has used a questionnaire tool that amalgamated close-ended and open-ended types. The items have been modified and rewritten to the study context though they were adapted from different literatures and studies; for instances, the Digital Technology Mindsets from(Anderson and Groulx, 2011; Barcelona and Dela Cruz, 2024; Raygan and Moradkhani, 2024); Technology Use Practices from(Um, 2021; Anderson and Groulx, 2011; Kuo et al., 2014; Gower et al., 2023; Getnet et al., 2024; Hori and Fujii, 2021; Isrok'atun et al., 2022); and collaborative skills from (Shen et al., 2008; Yu, 2018; Kuo et al., 2014; Suana, 2018; R.J. Chu and A.Z. Chu, 2009; Jördens et al., 2024).

Including biographical information of the participants, **40** items were developed to catch up the students' self-reports. Thirty seven of these were used with likert scale. The reliability obtained by pilot test with instruments of growth mastery mindset(**12** items, Serial No.4 to 15) was .78; dynamic technologies experience(**15** items, Serial No.16 to 30) was .81 and alpha of .76 on the students' collaboration skills(**10** items, Serial No. 31 to 40). Therefore, the items were found acceptable for the current study. Qualitative open-ended questions were provided at the end of each section of close-ended tools. Students who filled the questionnaire also wrote their personal opinions as narrative summary for each section. Then, their scripts were sorted into thematic codes; according to their concerns and used for qualitative report.

As a data analysis method, questionnaire tool reports were fed to statistical software for social sciences known as SPSS- version-27. Preliminary session including measures of central tendencies (mean, standard deviations, variances, skewness and kurtosis) and descriptive frequency analysis had been employed. Then, Pearson Product Moment Correlation has been conducted with the study variables. It is believed that students' digital mindset, collaboration experience, and dynamic practices have inherent relationship given the same population of study. Furthermore, one way analysis of variance (ANOVA) was used to find out learner differences. In the regression method, the Multivariate Linear Regression (MLR) known as Univariate technique has been used during the data analysis. Consequently, multicollinearity was tested using the Variance inflation Factor (VIF), histograms, P-plots, skewness and kurtosis. Finally, main findings, data discussions, pedagogical implications and research gaps were recommended.

3. Analysis of Results

Based on various demographic backgrounds such as student sex or gender, departments and ecology experiences (rural and urban), 265 preservice students were invited to participate on the current study. The demographic factors depicted in the first table below.

Table-1: The sampled participants' demography

Preliminaries			
Categories		**Value Label**	**N**
Sex of students	1	Female	132
	2	Male	133
Ecological BG	1	Rural	171
	2	Urban	94
Field of Study	1	Social Sciences	134
	2	Natural Sciences	131
	Total	N	265

The above data displays that both the natural science(131) and the social science(134) students had participated on the current study. As mentioned earlier, these participants have been proportionally drawn from various departments of study: Environmental Science, Physical and health Education, Mathematics, English Language, Afan Oromo Language, Amharic Language and Moral Education-Safuu.

Nevertheless, all of them have reported that they have started their ICT education in grade nine and still taking its course. These students were also incorporated in the study from various ecological backgrounds-rural(171) and urban(94). This gap has happened due to the available population from urban background and in the process of MSS. It was also observed that from the participants approximately 50%(132) were female and 50%(133) were male students. Though there were constraints during data gathering, this proportion is almost near to balance in counts but slightly differs when changed to percentage; i.e., 49.81% and 50.19% respectively.

Table-2. Descriptive and assumption parameters

Descriptive Statistics								
	N	Min.	Max.	Mean	SD	Skewness		Kurtosis	
						Stat.	Std. Error	Stat.	Std. Error
Digital Learning Mindsets	265	3.70	4.45	4.10	.18	.25	.15	− .69	.29
Digital Collaborative Efficacy	265	3.20	4.25	3.72	.24	− .17	.15	− .44	.29
Digital Use Experiences	265	3.35	4.35	3.87	.23	− .22	.15	− .69	.29
Valid N (listwise)	265								

Then, the first research question the “How is the relationship between digital growth mindset, Connectivist/collaboration skill and dynamic technology practice among preservice teachers?” was answered using Pearson correlation statistics given by regression method. Primarily it serves to answer this question; secondly it sets up the forth coming regression analysis with independent variables and the dependent variable. Thus, the following table depicts these relationships but without asterisks because regression correlations are not produced with them; rather researchers notify about significance types(Morgan, 2005).

Table-3: The Correlation Statistics based on the 95% CI

	Pearson Correlation	Sig. (2-tailed)	95% Confidence Intervals (2-tailed)[a]	
			Lower	Upper
Digital Learning Mindsets with Digital Use Experiences	.509	.000	.413	.592
Digital Learning Mindsets with Digital Collaborative Efficacy	.518	.000	.423	.600
Digital Use Experiences with Digital Collaborative Efficacy	.422	.000	.317	.516
a. Estimation is based on Fisher's r-to-z transformation with bias adjustment.				

As the demonstrated in table 2, almost all the study variables recorded positive and significant relationship. In larger population, a correlation in lower terms are also acceptable as long as they have showed significant values(Jackson, 2015; Morgan, 2005 and Stockemer, 2019). For instance, the preservice students’ growth mindset for digital technology has displayed moderately good association with their collaboration skills while using digital dynamics(R = .518**, Sig. = 0.000, two tailed at the 95%

CI, N = 265). Considering that the population is moderately large, DLM has also demonstrated moderate relationship with the students' digital technology use experiences(R = .509**, Sig. p = 0.000, two tailed at the 95% CI). Also students' reported collaboration skill has disclosed statistically significant and positive association with their digital technology experiences(R = .422**, Sig. p = 0.000, two tailed at the 95% CI). Such relationships have implications for the cause effect relation (Stockemer, 2019 and Pallant, 2016).

If variables of a study were successfully selected, they can have significant relationships and serve for other examinations such as analysing impacts on the assumed dependent variable- digital practices. Thus, the current study has successfully detected the relationships between students' digital learning mindsets, digital use experiences and their collaboration efficacy. As an instance, a study by Yang and Wang(2025) study yielded positive correlation between learners' everyday technology usage and their e-learning readiness(Pearson R = .17, p < .01, N = 504); learners' everyday technology usage and their emotion regulation were found to be positively correlated(Pearson R = .20, p < .01, N = 504), and learners' e-learning readiness with learners' emotion regulation(Pearson R = .85, p < .01, N = 504).

In order to answer the second research question stated as "To what extent students' digital mastery growth mindset and collaboration skill contribute to their dynamic technology practices for academic learning? If so, what are the students' views?"; assumptions have to be tested based on different evidences proposed by authorities in the field. Using enter method on SPSS via MLR Univariate method, the contributions of predictor variables over the students' dynamic digital exercises has been detected.

As Hair et al(2022) and Ringle and Sarstedt(2021) exclaim independent variables or regressors should correlate with one another and with the dependent variable(s) to varying degrees, usually to the moderate levels. Furthermore, multicollinearity assumptions have been cautiously carried out. All the independent variables excluded non-zero-order correlations and have good tolerance and variable inflation factor (VIF) given by statistical assumptions as indicate in tables below.

Using enter method on SPSS(version 27) via MLR Univariate method, the contributions of predictor variables over the students' dynamic digital exercises has been detected. Then interpretations were made with the use of R Square(R^2) and Beta(β) coefficients(Kline, 2016; Morgan, 2005 and Hair et al., 2022; Pallant, 2016; Stockemer, 2019; Tabachnick and Fidell, 2007; Darlington and Hayes, 2017). According to Cohen (1989), as cited in McArthur et al, 2018 and Banihashem et al., 2023, the value of R^2 is divided into three levels, namely R^2 =.02 indicates weak, R^2 =.13 indicates moderate level, and R^2 =.26 indicates high level. Hair and Alamer(2022), on the other hand, recommended the use of beta for predicting power of study variables demarcating that a beta of 0 to 0.10, 0.11 to 0.30, 0.31 to 0.50, and a value > 0.50 considered as small, modest, moderate, and large effect sizes, respectively. From such premises and the likes, we can evaluate the prediction power of the current study variables by rounding off where appropriate to do so.

According to the R Square rule explained above, the predictor variables have high influential power over students technology practices (R^2 = .293, see table-4).

Table-4. Regression based on coefficient of determination R

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.541[a]	.293	.288	.195	1.79
a. Predictors: (Constant), Digital Collaborative Efficacy, Digital Learning Mindsets					
b. Dependent Variable: Digital Use Experiences					

As Hair et al(2022) and Ringle and Sarstedt(2021) exclaim independent variables or regressors should correlate with one another and with the dependent variable(s) to varying degrees. This has been tested earlier. Also normality and multicollinearity assumptions have been cautiously carried out. All the independent variables excluded non-zero-order correlations and have good tolerance and variable inflation factor(VIF) given by statistical assumptions which is .732 at 1.36.

Table-5. Beta Variance and collinearity test

Coefficients[a]								
Model					t	Sig.	Collinearity	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.047	.275		3.8	.000		
	Digital Learning Mindsets	.503	.077	.396	6.5	.000	.732	1.36
	Digital Collaborative Efficacy	.206	.058	.217	3.5	.000	.732	1.36
a. Dependent Variable: Digital Use Experiences								

As can be seen in the above tabular information, the independent variables digital mastery growth or mindset and collaboration abilities have successively affected students' dynamic technologies practice(R^2 = 0.29). The digital mastery growth yielded a beta of .396 variance on the dependent factor which means a moderate effect size according to this technique. On the other hand, students' collaboration ability has predicted a variance unit (given β = .217, t = 3.5 at p = .000) which has modest effect as discussed earlier (Hair and Alamer, 2022). Therefore, we can imagine that students' use of dynamic technologies such as ChatGPT, Tiktok, Telegram, Youtube, Messenger, Duo lingo, email, Twitter, Facebook etc. can be affected by their mastery growth mindset and collaborative practices or prior skills (see He and Wen, 2025).

Digital growth mastery and collaborative skills can influence students' use of dynamic technology in their academic careers. This was also substantiated by some selected frequency report obtained from

student filled questionnaire as below. It was also narrated in quotations.

Table-6: Frequency table on student mastery growth mindset

Item	Digital Technology mindset, N = 265	Never + quite few F(%)	Fairly Enough + A lot+ Quite a lot F(%)
6.	I believe that using digital technology can develop my learning motivations, task interests and autonomy practices.	46(17%)	219(83%)
7.	I feel that searching educational material resources with digitals like computers, smartphones, tablets, iPhones and laptops more support one's learning.	45(17%)	220(83%)
10.	I believe that using digital technology can develop my higher order thinking skills	41(15.5%)	224(84.5%)
14.	If you have strong technology experience such as ICT skills, then you can more develop your professional agency as a teacher	35(13%)	230(87%)

The frequency report information given in table 6 indicated the extent to which preservice students' conceive technology use in education. Based on the Item-6, we can deduce that about 83%(219 students) were found conscious about digital education. They reported that technology can enhance their motivation to learn, interest in using tasks from technology and further their learning autonomy. In the same vein, preservice teachers believe that technology use can develop their professional agency. Utilizing Item-14, about 87%(230) of college students reported using technology can develop their teaching profession in the future. This information has also been supported in student scripts given on open-ended question:

I like learning with technology. I wish to use it in my profession as a teacher(SS70 from mathematics department). I want to be a Mathematics teacher. I want to use multimodal technology, composing my notes to teach and even learn English words for that(SS75). I want to be a good English teacher. I have good confidence in technology like computers(SS133). My school was far in rural and has no more such devices. Now I am in college. I want their support because I want to use it in my career. We are living in the world of technology. Surely we need it!(SS238).

This script from the three field of study: Mathematics, English and Amharic students have reported that their professional agency shall be cultivated with technology competence. Professional digital competence(PDC) is one of the most important teacher agency development(Andreasen et al., 2022; Coşkunserçe and Aydoğdu, 2022). The authors exclaimed that teachers who have equipped technology competence can better support their student learning needs and can direct students in technology use

for their learning. Never the less, many students have also narrated about their technology use experiences and the types they have been using for their learning as follows:

I like to use technology in my free time, out of class, but in college there is no internet access. I hope it will be improved in next year such as computers and the rooms(SS122). Ok, thank you for giving me the opportunity on this area. Already my confidence in using technology is good. I can use many types such as the Telegram, Youtube, Messenger Chats, WhatsApp(SS159). I use technology such as smart phone. I use it every day as part of my life because I need to improve my ability especially new technologies(SS138).

These narrative reports synonymously informed the data information provided in Table 7 that conveyed students' digital use experiences. College students want to excel their use experiences via different technology platforms such as Telegram, Facebook, Youtube, WhatsApp, Tiktok, ChatGPT, Messenger, IMO and so on. They have wrote that they had such experiences even during the COVID-19 pandemic-when they were in high schools.

Table-7: Frequency table on student digital use experiences

Table 7

provides student digital technology use experiences such as free online books, doing lesson tasks and securing their personal security while using technological gadgets. They have high motives for online access and doing online tests(See Item-32). More important information was exploited with item-21 which reported that students were doing online activities when they were in high school. A study by Tri and Nguyen(2014) reported that the vast majority of students participated(82.6%) perceived that ICT usage had a positive effect on English language learning. The students had used ICT for learning the major EFL skills though they were dominantly using it for non-learning activities as the authors found. However, in the current study students have reported about 87.5% compared to 4% utilization of ICT resources.

Item	Digital Use Experiences, N = 265	Never + quite few F(%)	Fairly Enough + A lot+ Quite a lot F(%)
21.	I have been doing online exercises, tests and activities smoothly and comfortably.	33(12.5%)	232(87.5%)
26.	I can avoid, unsubscribe and block harmful online messages(words, pictures, or videos) sent by others.	50(19%)	215(81%)
27.	I use digital learning resources to support my study strategies and visual styles.	37(14%)	228(86%)
30.	I can access and open the free online library-save and share documents eg.pdf books	46(17%)	219(83%)
32.	Currently I am motivated to search for and do online exercises and tests.	38(14%)	227(86%)

Likewise, Gebremeskel, Kumar and Kamalakannan(2018) found that students at Adigrat University reported that the students use 86.1% Facebook, IMO 34.9%, Telegram 19.6% Viber 29.2% and so on. In the current study only about 12.5% of the respondents had negligibly participated as given by the likert

scales(Never to Quite Few). Also few students reported that they hardly avoid or protect the technology platforms they privately use. As technology tools are also complex phenomenon, some students may not have full experience so that 19% of them afraid to be confident on the given question. Furthermore, preservice students have confidence in collaborative digital learning. Table 8 displays this information below.

Table-8: Student teachers' Digital collaborative learning efficacy

Item	Digital collaborative efficacy of students, N = 265	Never + quite few F(%)	Fairly Enough + A lot+ Quite a lot F(%)
36.	While sharing learning contents on digital tools, I can keep safe and eco-friendly for example, thanking for the share, encouraging next share etc.	60(22.6%)	205(77.4%)
38.	While communicating online with others, I develop my learning personalities.	38(14%)	227(86%)
39.	If needed, I can meet my classmates and teachers online face-to-face such as by zooming.	51(19%)	214(81%)
40.	Having access to other students' questions and answers on digital platforms helps me in answering doing my assignments and questions.	51(19%)	214(81%)

The third issue of this study was to investigate demographical variation among preservice teachers which may implicate about their digital skills and practices as given by field of studies, gender and previous residence or ecology. The main hypothesized question was "Is there any significant difference between female and male students on digital growth mindset, collaboration skill and dynamic technology practices?"

As it was detected by independent tests (see table-10 first row), there was no gender difference with students' digital growth mindset(F(.74, 263), t= .53, CI 90%, LL = − .032, UL= .056 and not significant). This was further detected that the Levene's significance value was greater than the expected alpha value-usually at 0.05 which means that no difference existed by gender. The 95% CI limits also supported this test; i.e. Lower limit = − .032 and upper limit = .056.

Table-9. Descriptive statistics of gender difference

Group Statistics					
	Sex of students	N	Mean	Std. Deviation	Std. Error Mean
Digital Learning Mindset	Female	113	4.10	.17	.01
	Male	152	4.09	.18	.01
Digital Collaborative Efficacy	Female	113	3.73	.21	.02
	Male	152	3.72	.26	.02
Digital Use Experiences	Female	113	3.88	.23	.02
	Male	152	3.87	.23	.01

The participants were categorized by gender before the analysis. There were 113 female students and 152 male students obtained from the categorical data detected by SPSS software. This indicates 19 female were categorized into male data same report according the software detection. The mean average given in this table is the spring board to detect the gender differences in the next analysis.

Table-10. Independent T-test for mean differences

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.	MD	Std. Error	95% CI	
									Lower	Upper
Digital Learning Mindsets	Equality assumed	.74	.38	.53	263	.59	.01	.02	− .032	.056
	Equality not assumed			.53	247	.59	.01	.02	− .032	.056
Digital Collaborative Efficacy	Equality assumed	5.9	.01	.38	263	.69	.01	.03	− .047	.071
	Equality not assumed			.40	260	.68	.01	.02	− .046	.069
Digital Use Experiences	Equality assumed	.20	.64	.35	263	.72	.01	.02	− .046	.067
	Equality not assumed			.35	241	.72	.01	.02	− .046	.067

Also there is no significant difference between male and female students regarding using different technologies (Table-10). However, there is gender difference on collaborative abilities though the mean difference is small. Students' narrative response to the final item given with open-ended for opinion collection can be triangulated here. There were such reports from different departments:

Using technology helps in getting more learning. But it needs sufficient knowledge of ICT. If we want the generation grow up, supports are needed. In my secondary school education-in rural town, there is lack of computers and I couldn't get fair knowledge in ICT use; I wanted it now(SS201). In high schools we learned ICT in theories(SS201); however, through my effortful practice I could use todays' technologies for my study. That is not enough because in practice our teachers did not do it(SS74). …We who have lack of economy should get good access to technology here(SS113).

The reason for collaboration efficacy may be attributed to insufficient digital technology, internet access, lack of energy power, use centers among rural towns. As some students reported there were also lack of focus on practices among their ICT teachers. There should be competent technology teachers who can cultivate students in technology practical applications such as browsing materials, using Microsoft offices such as power point, excel, dimension tools and graphics so that they can support their learning strategies.

4. Discussion

The primary intention for this study was to detect the associations between those selected factors in need for technology based education because it was conceived that using digital technology in education sector paramount not only to citizen's academic and personal growth but also to one's community and national development. Students' digital growth mindset, collaboration skills and use of digitally dynamic tools were chosen factors for this study. Thus, it was meant to explore their impacts on preservice. Secondly, it was to know practicality difference among students.

Correlational analysis implicated students' mastery growth mindset, collaboration and digital practices. To begin with, digital learning mindset has been found contributing to student experiences in applying dynamic technologies in student education. One reason could be that students have been exercising digital technology in their past experiences because they have been learning ICT as a subject since grade 9.

Eventhough the current study is based on multiple variables, each phenomena can be associated with findings in other studies in the world. Some researchers found no relationships; some found no contributions and vice versa. The mean values accessed on the variables are also good indicators which shed light on such studies, thus debates in the area of technology practices is still perpetuated. The findings of the current study also concurred with other studies in the area of technology use experience among higher institution students(See, Kim et al., 2019; Aabeyir et al., 2025; Isrok'atun et al., 2022; Lausa et al., 2024; Aldosari, 2025; Mahawan, 2025; Sreymao and Park, 2025; García-Valcárcel and Mena, 2016 and Wang et al., 2022). In Cambodia, Sreymao and Park have investigated the effects of computer

self-efficacy and motivation in online learning on college students' satisfaction with focus on the mediating role of self-directed learning. They found the reasonable relationship among their study variables and able to detect their mediation factors. In Nguon and Ali(2025) study in Cambodia, students' self-efficacy mediated the relationship between their ICT skills and learning outcome.

As to the current study it has been found that students' more than 80% college students have experience in using digital technologies which is synonymous with that of Kim et al(2019) investigation. Such practices also have significant and positive relationships with students' mastery mindsets and collaborative experience. Whatever, digital resources and infrastructures avail, students' mindset to digital learning matter so far. It is their readiness that allow instructors and curricular practices in the implementation of dynamic technologies for learning. This students' technology use experience and readiness is concurrent with other findings in the world(Lausa et al., 2024; Bashir and Jimmy, 2023; Anderson and Groulx, 2011; Jan, 2015; Adams et al., 2022; Instefjord and Munthe, 2017; Hatlevik, I. and Hatlevik, O., 2018; Getnet et al., 2024; Nguon and Ali, 2025; Clifford et al., 2018; Giles and Kent, 2016; Coşkunserçe and Aydoğdu,2022; He and Wen, 2025).

Students ICT skills contribute to students' technology use confidence and boost their academic performances, professional confidence and social life performances. This may cultivate students' mastery growth in using various technologies which was also disclosed in the current study data. The cumulative frequencies given on each item has depicted 85% and above. This implicates that students need to have sufficient internet access and computer desktops in their college so that they can mastery learning with advanced technology platforms.

Yang and Wang(2025) have also found that there was small to high correlation between students technology usage, emotional regulation and learning readiness. It was found that learners' everyday technology usage and their e-learning readiness was small (Pearson $R = .17$, $p < .01$, $N = 504$); learners' everyday technology usage and their emotion regulation was small(Pearson $R = .20$, $p < .01$, $N = 504$), but the learners' e-learning readiness with learners' emotion regulation was strong(Pearson $R = .85$, $p < .01$, $N = 504$). Clifford et al.(2018) found and exclaimed that there was significant positive relationship between internet access and usage and students assignment submission, but the ICT correlation was weak with these factors($r = .105$). In the current study, however, students' mindset towards technology has good relationship as dictated above.

Also Giles and Kent(2016) indicated that preservice teachers' self-efficacy beliefs related to integrating technology into instruction. The research question was examined using descriptive statistics. Data indicated that almost all (93%) of the participants incorporated technology into the lessons they taught with the majority (68%) of participants reporting a high level of confidence in their ability to select and utilize technology in teaching. Further, 89% of the participants felt they could integrate technology across the curriculum with 80% indicating they were capable of determining the why, when, and how to do so most of the time. Therefore, technology experiences support preservice teachers in developing not only their academic performances but also their professional agency.

Enriquez (2025) used descriptive frequency on the university learners' technology use awareness. Results showed that senior high students(N = 362) had moderate awareness of online library services and resources, but rarely used its services. The students underscored moderate awareness of their library's online services (M = 3.19) and digital resources (M = 3.48). However, they were slightly aware of the online databases which are commercial(M = 2.03) and Open Educational Resources (M = 2.02). Nevertheless, students rarely used online library services (M = 1.90) and accessed online resources only sometimes (M = 2.57) as discovered by the author. However, they never used commercial databases (M = 1.42) and Open Educational Resources (M = 1.41). According to the author, there was no significant difference on students' demographic profile like grade level except on the awareness of commercial databases. That is grade 12 students were relatively more aware of such digital resources than those grade 11 students.

Ojok(2018) has studied ICT access to students in Ugandan public universities. The purpose to explore the extent to which visually impaired students accessed and utilized technology resources for their learning. The majority students, about 70.5% have reported that they have access to internet in their universities. About 60% of them know that their institution has e-learning platforms but the majority of the students studied didn't use the e-resources of their universities. The researcher concluded that about 40% of those students were intermediate users and 37% were beginner users of ICT resources. Compared to this study, about 87.5% students in FCTE- Ethiopia can use digital resources but have no sufficient access and sufficient ICT stations in college.

This study also concurred with some recent studies in the area of gender variation in technology experience and collaboration efficacy. Mahawan(2025) has dealt with preservice teachers' ICT literacy, self-efficacy, access, management, producing experiences and gender differences by using 135 Philippine students who were on their actual school practices. There were strong relationship between those study variables. The researcher also found that the preservice students have moderate and high skills, access ability, management, self-efficacy in ICT but medium production capacities. The study also found that female students were better than their male counterparts. In the current study, the students were synonymous in growth mindset but significantly differed in collaboration skills like on online communications.

Another study by Ibrahim and Aldawsari(2023) found similar relationship on the use of ICT skills and student performances as mediated by their efficacy beliefs. Consequently the current study had also found reasonable and indicative relationship among the student mindset, use experience, collaboration and gender difference(Ben Youssef et al., 2022; Afzal et al., 2023; Wang et al., 2022; Shaengchart and Bhumpenpein, 2025; Rezai et al., 2024 and Suana, 2018). The students have got sufficient experiences when we detect the mean scores and percentages as studied these factors. Kim et al(2019) have examined students engaging in university e-learning environments in relation to their perceptions of e-learning, digital readiness, academic engagement, and academic achievement. Most of their hypotheses tested positive and significant relationship with variables. As to their survey report, college students

were good adopters of e-learning applications and devices, including smart phones, tablets, or laptops, for their academic work which is congruent to the current findings.

A study by Khasawneh (2024) found that there was gender difference in technology use. The aim was to analyze the relationship between gender variation and technology adaptation in language learning among 394 foreign language undergraduate students. As the author explains gender variation influences language learners' acceptance (mean score = 4.10), use of technology (mean score = 3.50), and perceptions of the effectiveness of technology (mean score = 2.80). Vázquez-Cano et al(2017) have also detected male university students differed in digital competence particularly in email practices and online presentations as compared to females. In contrast to the current study, there was no gender difference in using digital technologies even though their collaboration skills yielded difference by Levene's variance, but still there is no significant mean difference observed. Suana (2018) also found that there were no significant gender differences on accessing internet and use efficacy for learning physics lessons. However, female students were better at the ownership of computers and mobile phone technologies.

On the other hand, Ben Youssef et al.(2022) studied digital divide among students who were studying in different universities in France. Among the four main variables they had studied, they found that digital divide significantly existed among the university students. They were surprised that the digital divide still existed in France. They connoted this term to inequality of access to technology devices and resources; especially ICT tools like tablets, internet and broadband uses. However, this cannot be a surprise in Ethiopia where technology issue is not more than a decade's phenomenon.

From the current study, in general, we can infer that digital mindset of students, use experiences and digital learning collaboration skills have evidential associations. Furthermore, psychological factors such as mastery growth about technology and collaboration skill can impact students' technology use experience which should be more supported with digital infrastructures and professional educators.

5. Major Implications and recommendations

In the first place, this study indicates that Students who possess technology mastery mindset can enhance their academic careers with various technology tools by browsing learning resources they want. They can collaboratively do so. As students' qualitative responses indicate, using technology in education is not optional but it is the right to technology right to become a competent professionals in the fastest world trends. Like or not like, technology is changing in exponential magnitude since the new millennium (2000) and we would experience new technologies in the few decades in the future. If students are not well equipped with it today, especially in HEI, they may not handle with latest technological events in later professions and even in life events. This was one of the worries college students have reported during the study. Thus, teacher trainees shall be supported in using technology for education according to their growth mindsets, experiences and access opportunities. There should be sufficient infrastructure such as internet access, computer access, comprehensive digital library

resources in education colleges so that teacher trainees cultivate their professional agency using various online resources and teacher experiences.

A valuable amount should be specified for education sector in the budget. In order to train 21st century teachers, ICT course is irreplaceable. For instance, students are expected to take a course in technology integration during their second year (MoE, 2023). Eventhough student learning modules have been proposed and written for ICT courses, much of them revolve around ICT theory rather than actual practices in profession training. However, scholars recommend to follow four approaches in designing ICT learning courses in pedagogy: the ICT skills development approach, the ICT pedagogy approach; the subject specific approach and the practice driven(design) approach. Thus, their module shall be redesigned as to hands-on approach. This study may endorse for such scientific approaches. Like the other sectors such as bank, health and constructions etc., more qualified ICT experts should be rendered to education schools to support and update student experiences.

Student teachers shall be frequently trained with new technologies they can use for academics so that they would become 21st century competent teachers. Partly because many world teachers had encountered challenges in handling remote student learning during the COVID-19 Pandemic. By the time, student education was heavily damaged in Ethiopia, too. As study by Equlinet et al.(2024) indicates that higher institution teachers have favorable acceptance to use technology in student learning. Therefore, the management has to practically support such intentions in college educations as well as in their distance courses. Even the current world trend is implicating students and teachers have to be exposed to emerging technologies like AI practices. Last but not the least, college educators should enhance students' technology use and mastery growth through their lesson contents so that students become competent in the world of technology and profession.

Some of the potential limitations were identified in this study. Many studies depict gender differences in technology practices; however, the current study couldn't yield such differences using large population in the study. This shall be further investigated in different educational institutions or in any setting. Equivocally other student backgrounds such as age, school types urbanism, access needs, socioeconomics, field of studies and socioemotional experiences of students shall be tested in gender differences when applying technology in education. Socio-economic background and geographical location have a significant impact on students' ability to engage with digital learning platforms(Aldosari, 2025).

The current study has been conducted only in one institution. Yet, other researchers can disseminate such a study to wider communities based on the time and budget they have on hand. For instance, methodologically sophisticated models can be produced by other researchers as the above study variables have a positive relationship and were found as psychological capitals in the educational environment.

Declarations

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Ethical issue: Research agreement received from FCTE; participants signed written consent.

Data Availability: The data can be provided accordingly or as requested.

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