The Impact of Digital Competence on Student Academic Achievement

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ABSTRACT:

In today's era of digital transition, the digital competence of university students is an important factor influencing academic success. The purpose of this study is to determine the relationship between digital competence and academic achievement of university students. The survey was conducted by questionnaire and measured in 5-step dimensions of Likert. This study included 402 undergraduate students enrolled in 37 majors. Digital competence was measured by a self-assessment questionnaire based on the European Union's DigComp 3.0 framework, while academic achievement was measured by a student's (GPA). Statistical methods and multi-step models were used in the data. The findings revealed a positive correlation of statistical significance between digital competence and academic achievement. In particular, digital content creation and problem-solving skills have been found to have the strongest impact on the GPA. These results indicate the need for systematic development of digital competence in university curricula.

Keywords: Digital Competence, Academic achievement, Higher Education, DigComp 3.0, Student introduction

1. INTRODUCTION

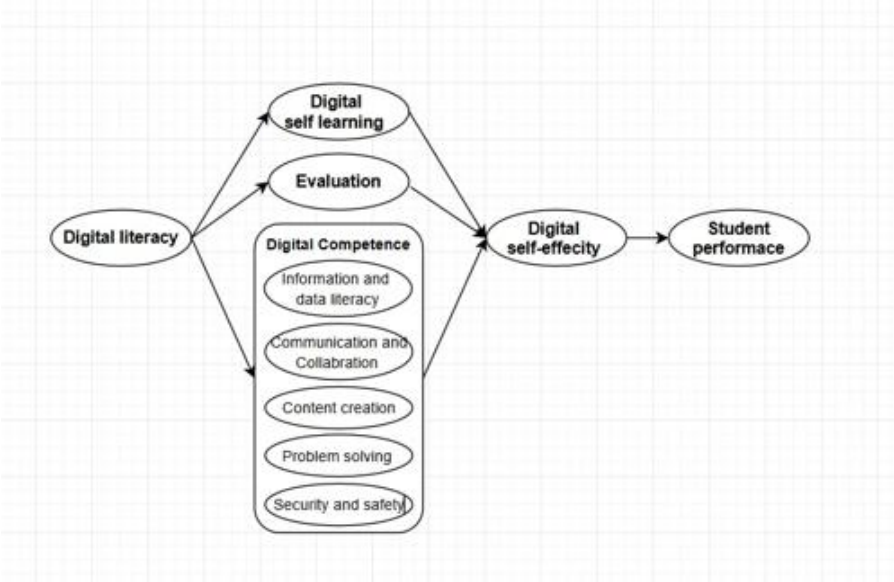
The rapid development of digital technology in recent years has brought significant changes to the field of higher education, with learning management systems, online collaboration tools, and digital content-based learning radically modernizing the teaching process for teachers and students. In such a situation, students need to have digital skills to judge, creatively use, and ethically use digital tools instead of just using them. Within DigComp 3.0, developed by the European Commission, digital competence is defined in five main frameworks: information and data processing, communication and collaboration, digital content creation, security, and problem

solving. These skills are considered essential for successful learning in a digitalized learning environment. There are few empirical studies that measure how students' digital competence affects academic success in the Mongolian universities. Therefore, this study aims to determine how students' digital device technology skills affect not only digital learning capabilities, digital skills and self-confidence, but also academic success in general.

2. THEORY AND METHODOLOGY

Digital competence is the sum of knowledge, skills, and attitudes to use digital technology effectively, safely, responsibly, and creatively. Digital Competition for Citizens (DigComp) developed by the European Union Joint Research Center defines digital competence as a combination of knowledge, skills and attitudes, and calls it a comprehensive concept focused on education, employment, and social participation. DigComp's latest version, DigComp 3.0 (2025), classifies digital capabilities in five main areas: information and data processing, communication and collaboration, digital content creation, security, and problem solving. [1, 2]. The OECD (2021) report emphasized that in order to successfully study in the digital environment, students need digital skills to judge, collaborate and solve problems, not just technology. [7] Researchers have concluded that digital competence in universities is directly related to the ability to learn independently and self-regulate, which is the basis for increasing learning outcomes. [10] Academic achievement is often measured by the GPA, exam results, and learning outcomes, and the GPA is an indicator widely used in educational research because it represents the overall performance of many of the student subjects. In recent years, empirical studies have been intensively conducted to establish the relationship between digital competence and student academic achievement. Song et al. (2025) A study of 312 Chinese university students found that digital learning competence has a statistically significant positive effect on academic achievement. For example, when the ability to evaluate digital learning increased by one unit, academic achievement increased by 0.48 points. [5, 11] Also, a study conducted by Victor & Ujir (2025) among students at the University of Malaysia found that digital competence is a strong predictor of academic performance, and information and data processing, security, and problem-solving skills were the most important. [6] There have also been studies that have shown that digital competence indirectly affects academic achievement. Zakir et al. (2025) analysed the link between digital literacy and academic achievement through structural equation models, which found that digital competence, digital self-confidence, and informal digital learning function as intermediate variables. [7] Similarly, Li et al. (2025) found that there is a moderate positive relationship between digital literacy, competence and academic achievement from meta-analysis of 35 studies, highlighting that this correlation may change depending on the age, level, and environment of students. [8] The forementioned studies have been conducted internationally, and the lack of research conducted in Mongolia in this field is the basis for this research.

Figure 1. Research model



A) Research model elements

Digital competence was measured in a 59-question query based on DigComp 3.0, with answers taken in a 5-speed Lickert hierarchy. Academic achievement is determined by the student's GPA (GPA). The data was statistically determined using SPSS 25.0 and AMOS 23.0 programs, and a multi-step model was evaluated.

B. Research hypothesis

\H1: Digital literacy will positively impact Digital Competency Sectors (Information, Communication, Content, Security, Problem Solving).

H2: Digital literacy has a direct positive effect on Digital Learning Competence and Data Verification.

H3: Digital literacy can have a positive impact through Digital Capability (DigComp) and digital self-confidence.

H4: Digital Capability (DigComp) can have a positive effect on self-confidence.

H5: Digital self-confidence has a direct positive effect on learning success.

H6: Digital Competence (DigComp) indirectly affects learning success through self-confidence.

3. RESEARCH RESULTS

TABLE 1. GENERAL INFORMATION ON THE PARTICIPANTS IN THE STUDY

Specifications	n=402
Course of study	
1st year	280 (69.7 %)
2nd year	48 (11.9%)
3rd year	23 (5.4%)
4th year	52 (12.3)
Хүйс	
Male	234 (58.2%)
Female	168 (41.8%)
Frequency of using digital devices (computers, tablets, smartphones)	
Constantly	54 (13.4%)
Mostly	211 (52.2%)
Rarely	137 (34.1%)

GPA	
Below 2.0	7 (5%)
2.1 – 2.5	23 (16.4%)
2.6 - 3.0	29 (20.7%)
3.1 - 3.5	49 (35%)
3.6 & above	32 (22.9%)

The average of the participants' digital skills is as follows:

TABLE 2. AVERAGES

Specifictions	Averages	**Σ** =SD
Learning outcomes	3.31	± 0.9
Digital literacy	3.29	± 0.8
Digital self-confident	3.81	± 0.7
Compactivity	3.51	± 0.7
Learning ability	3.55	± 0.8
Digital competence (DigComp)		
Ability to access information	3.59	± 0.6
Digital communication skills	3.88	± 0.7
Create content	2.99	± 0.9
Problem solving	3.14	± 0.8
Security	3.59	± 0.8

Students' digital self-confidence (3.81±0.7) and digital communication skills (3.88±0.7) were the highest or positive. This indicates that students are relatively psychologically prepared to communicate with others and use digital tools with the help of digital tools. In addition, students' ability to learn independently using electronic and digital tools (3.55±0.8), ability to verify information and resources (3.51±0.7) and security knowledge (3.59 ±0.8) are above average, while digital literacy (3.29 ±0.8) and general learning outcomes (3.31 ±0.9) are relatively similar. DigComp, on the other hand, has the lowest average score of digital content creation ability (2.99 ±0.9) among the branch competencies of the theoretical framework, which shows that additional support and training are needed for students in terms of new information processing and creative content production. The average problem-solving ability score is 3.14 ±0.8, which indicates that the ability to independently solve technical and methodological problems is insufficient. In conclusion, it can be concluded that students are superior in terms of communication, cooperation and self-confidence, but average in terms of creative activities and technical problem solving.

When checking the conformity of the structural equation model, χ^2/df =2.552 is within the threshold, indicating that RMSEA = 0.063 is well enough in line with model data. Although the p value of the Chi square test was statistically significant, it was not used as a key criterion due to its sensitivity to sample size. However, when considering relative conformity indicators such as CFI (0.876), TLI (0.865), NFI (0.810) and other criteria together, the model is considered universally acceptable.

TABLE 3. RELIABILITY INDICATORS

Constructs	Items	Estimate	Mean μ	CR validity
Data	Data_Cap1	0.613	0.5620	0.8647
	Data_Cap2	0.615		
	Data_Cap3	0.746		
	Data_Cap5	0.695		
	Data_Cap6	0.679		
Comm	Comm1	0.831	0.5918	0.8088
	Comm2	0.803		
	Comm3	0.556		
Content	Content1	0.808	0.6623	0.7968
	Content2	0.825		
Safety	safety1	0.805	0.7178	0.8357
	safety2	0.832		
Solve	Solve1	0.826	0.7147	0.8823
	Solve2	0.757		
	Solve4	0.755		
	Solve5	0.646		
Tech	Tech1	0.764	0.6062	0.9556
	Tech2	0.838		
	Tech3	0.834		
	Tech4	0.807		
	Tech5	0.746		
	Tech6	0.771		
	Tech7	0.755		
	Tech8	0.758		
	Tech9	0.75		
	Tech10	0.796		
	Tech11	0.755		
	Tech12	0.77		
	Tech13	0.781		
	Tech14	0.608		
	Tech15	0.793		
Perform	Perfor1	0.728	0.5823	0.8054
	Perfor2	0.807		
	Perfor4	0.646		
Reliable	reliability2	0.843	0.6838	0.8655
	reliability3	0.796		
	reliability4	0.688		
	reliability5	0.713		
Learning	Learning1	0.709	0.6356	0.8393
	Learning2	0.705		
	Learning3	0.827		
	Learning4	0.733		
Efficacy	Efficacy7	0.709	0.6598	0.9311
	Efficacy6	0.842		

	Efficacy5	0.79		
	Efficacy4	0.796		
	Efficacy3	0.723		
	Efficacy2	0.722		
	Efficacy1	0.702		

The results of the structural model direct correlation analysis show that technological skills are digital learning competence (β = 0.475, p < .001), verification ability (β = 0.475, p < 001), security (β = 0.479, p < 001), problem-solving ability (β = 0.637, p < 001), content creation ability (β = 0.661, p < 001), it has been determined that digital communication skills (β = 0.451, p < .001) and data access (β = 0.406, p < 001) have a statistically significant positive effect. However, the effect of Technological Skills on digital self-confidence (β = −0.136, p > .05) and learning outcomes (β = 0.043, p > 05) was statistically insignificant. This suggests that Technological skills are likely to influence learning outcomes indirectly and through other digital capabilities.

TABLE 3. DEPENDENCE RESULTS -1

Dependence (road)	**Direct correlation**			
	Estimate	S.E.	C.R.	P
Technological Skills (TS) => Digital Learning Competence	0.475	0.05	9.495	***
Technological Skills => Compaction	0.475	0.047	10.132	***
Technological Skills => Security	0.479	0.049	9.876	***
Technological Skills => Problem Solving	0.637	0.052	12.213	***
Technological Skills => Content Creation	0.661	0.063	10.516	***
Technological Skills => Digital Communication Skills	0.451	0.046	9.747	***
Technological skills =>	0.406	0.045	9.069	***

Information access				
Technological Skills => Digital Self-confidence	-0.136	0.083	-1.627	0.104
Technological Skills => Learning Results	0.043	0.158	0.275	0.783

As part of the research, the results of regression analysis of how the indicators of the field of digital competence affect the student's self-confidence (Self-efficacy) showed that most of the correlations have a positive effect of statistical significance. For example, learning ability is the strongest self-confidence determinant B=0.41, P<0.001), while digital communication skills β =0.255, P=0.009) and data verification skills β =0.2, P=0.01) are students' psychological preparation. It also contributes to strengthening self-confidence. Access to information β =0.184, P=0.003) and problem-solving β =0.13, P=0.042) have a positive effect on self-confidence, which is confirmed by the level of statistical importance (P<0.05). Interestingly, the ability to create digital content has a negative impact on self-confidence β =-0.118, P=0.017), which indicates that students may face more difficulties in the production of creative content, which may put some pressure on their self-confidence. However, a relationship between problem-solving skills and self-confidence (P=0.688) is statistically insignificant, so the impact of this direction cannot be directly confirmed.

TABLE 4. DEPENDENCE RESULTS -2

Dependence (road)	**Direct correlation**			
	Estimate	S.E.	C.R.	P
Learning Ability => Self-confidence	0.41	0.056	7.308	***
Compactivity => Self-confidence	0.2	0.078	2.563	0.01*
Ability to access information => Self-confidence	0.184	0.061	3.01	0.003**
Digital communication skills => Self-confidence	0.255	0.097	2.628	0.009**

Problem Solving => Confidence	0.13	0.064	2.029	0.042*
Content creation => Self-confidence	-0.118	0.05	-2.378	0.017*
Problem Solving => Confidence	-0.024	0.061	-0.402	**0.688**

Within Structural Equation Modeling (SEM), how technical ability affects student self-confidence (Self-efficacy) has been analyzed directly and indirectly. The results of the analysis showed that the direct correlation from technical ability to self-confidence was statistically insignificant β=-0.136, P=0.104). This suggests that basic technical knowledge alone does not directly increase a student's digital self-confidence. However, through direct effects analysis, it has been found that technical ability has a very strong positive effect on self-confidence through other capabilities. For example, technical ability increases self-confidence by 0.684 points through digital competence, learning ability and review ability, which is confirmed by a high level of statistical importance (P<0.001). Also, technical ability has a positive effect on self-confidence by 0.313 units (P=0.001) only through learning and verification skills. These results prove at the theoretical and practical level that "throughputs" are implemented by mastering digital capabilities (learning, review, communication, etc.). Therefore, it is essential to combine technical knowledge with other practical skills to increase student's digital self-confidence.

TABLE 5. DEPENDENCY ASSESSMENT

Dependence (road)	**Dependence**			
	Estimate	S.E.	C.R.	P
	Direct correlation			
Technical ability=> Confidence	-0.136	0.083	1.627	0.104
	Indirect correlation			
Technical Skills => (Digital Competence + Learning Ability + Compactivity) => Self-confidence			0.684	***

Technical Ability => (Learning Ability + Compactivity) => Self-confidence			0.313	0.001***

Digital Competency Industry Indicators Analyzing the impact of learning outcomes on direct and intermediate (transmission) relationships, digital self-confidence has the strongest direct positive effect on learning outcomes β=0.723, P<0.001). It was also found that security capabilities β=1.451, P<0.001) and learning ability β=0.206, P=0.024) have a direct positive effect on academic success with statistical significance. But the ability to verify β=-0.301), content creation β=-0.309) and problem-solving skills β=-0.499) have been observed to have a literal negative impact on learning outcomes, all of which are statistically significant at P<0.05 levels. According to the results of the Middle Dependency (Indirect effects), learning ability has a very strong positive effect on academic success by 0.221 points (P=0.001) through self-confidence it confirms that the student's self-learning approach is the main mechanism that leads to success by strengthening psychological self-confidence. In addition, digital communication skills β=0.11, P=0.031) and data access β=0.088, P=0.022) contribute positively to academic success. However, the ability to create content has a slight negative effect on learning outcomes β=-0.073, P=0.037) even indirectly, while the impact through review ability (P=0.058) and problem-solving ability (P=0.713) is statistically insignificant. out.

TABLE 6. RESULTS OF DIRECT AND INDIRECT IMPACT ANALYSIS

Dependence (route))	**Direct correlation**			**Indirect correlation**	
	Est.	C.R.	P	Est.	P
Digital station confidence => Learning outcomes	0.723	7.157	***		
Learning Competence => Learning Results	0.206	2.263	0.024*	0.221	0.0*
Compactivity => Learning outcomes	-0.301	-2.534	0.011*	0.098	0.058
Content creation => Learning outcomes	-0.309	-3.869	***	-0.073	0.037*

Problem Solving => Learning Results	-0.499	-3.62	***	-0.015	0.713
Security => Learning outcomes	1.451	8.89	***	0.074	0.086
Digital communication skills => Learning outcomes	-0.267	-1.789	0.074	0.111	0.031*
Access to information => Learning outcomes	-0.028	-0.296	0.767	0.088	0.022*

How technical skills affect learning outcomes (Performance) is analyzed directly and indirectly. According to the results of the regression analysis, the direct correlation from technical ability to learning results (beta=0.043, P=0.783$) was statistically insignificant. This indicates that basic technical knowledge alone will not directly affect the student's academic success. However, through direct effects analysis, technical ability has been found to have a strong positive effect on learning outcomes through digital competence and psychological factors. For example, technical ability increases academic achievement by 0.298 points through digital competence, learning and review capabilities, as well as self-confidence, which is confirmed by a high level of statistical importance (P<0.001). Also, the indirect effect through digital competence alone is 0.226 (P=0.002), while the impact through learning and review capabilities is 0.178 (P=0.004). These results are the "basic conditions" for learning achievement of basic technical skills (Technical skills), and this impact is the student's digital competence and self-confidence and it is confirmed that it is implemented as a real result through faith. Therefore, in order to improve the academic success of students, it is necessary to develop technical knowledge in a comprehensive manner with the fields of digital competence.

Modelling

Dependence (route)	**Dependence**			
	Approx.	S.E.	C.R.	P
	Direct correlation			
Technical skills	**0.043**	**0.158**	**0.275**	**0.783**
	Indirect correlation			
Technical Skills => (Digital Competence + Learning Ability + Compactivity + Self-			0.298	0.001***

Confidence) => Learning Results		
Technical Skills => (Learning Skills + Compactivity) =>Learning Results	0.178	0.004**
Technical skills => (Digital competence+ Learning ability + Compactivity)=>Learning results	0.261	0.001***
Technical ability => (Digital competence)=>Learning results	0.226	0.002**

4. CONCLUSION

1. This questionnaire and variable model is a theoretical structure that is fully compatible with empirical analysis of the impact on student academic success.

2. A student's digital competence has a positive impact on academic success.

4. Digital ability has a weak positive effect on self-confidence.

5. Digital content creation and problem-solving skills have the greatest impact on academic success.

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