

FACTORS INFLUENCING THE DEVELOPMENT OF DIGITAL COMPETENCE AMONG HIGH SCHOOL STUDENTS: A CASE STUDY IN HO CHI MINH CITY

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| INFORMATION | ABSTRACT |
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| <p><i>Received: 11/08/2025</i> <i>Revised: 16/08/2025</i> <i>Accepted for publication: 18/8/2025</i> <i>Code: TCKH-S03T08-2025-B10</i> <i>ISSN: 2354 - 0788</i></p> <p>Keywords: <i>Digital competence, high school students, factors influencing the digital competency of high school students, digital transformation.</i></p> | <p><i>This study aims to analyse the factors influencing the digital competence of high school students in Ho Chi Minh City, including factors related to the school, family, the learners themselves, and society. A mixed-methods approach was employed, combining a questionnaire survey with 364 students and teachers, in-depth interviews, and analysis of school records to collect both quantitative and qualitative data. The initial findings clearly identify the influencing factors and provide practical foundations for schools, families, and communities to design appropriate strategies to support the development of students’ digital competence in accordance with their needs and characteristics in the current context of digital transformation.</i></p> |

1. Introduction

In the context of extensive global digital transformation, digital competence has become one of the core competencies that need to be cultivated and developed for all citizens of the 21st century (Vuorikari et al., 2022; UNESCO, 2018). In general education, equipping students with digital competence not only meets the requirements of international integration but also helps narrow the digital divide, providing equitable access to knowledge and digital learning resources. Vietnam’s 2018 General Education curriculum has gradually integrated content related to digital competence through subjects such as Informatics, Technology as well as STEM education activities. However, practical implementation shows that students’ digital competence has not developed evenly

and is influenced by various factors such as school facilities, learning environment, family and school support as well as learners’ personal abilities (Litina & Miltuze, 2023; Shopova, 2014).

Ho Chi Minh City, the country’s largest economic, cultural and educational center, has been at the forefront of applying information technology and implementing digital transformation programs in education. However, disparities in socio-economic conditions among districts, along with variations in the scale and quality of educational institutions, have created a digital competence landscape for high school students that is both full of potential and marked by significant challenges. This situation underscores the need for in-depth research to clearly identify the influencing factors and assess their impacts within the specific context of the locality.

Globally, numerous studies have developed various digital competence frameworks, such as the European commission's Digital competence Framework (DigComp) (Vuorikari et al., 2022), UNESCO's ICT Competency Framework (2018) and the PISA 2025 assessment criteria (OECD, 2021). These frameworks share a common understanding that digital competence is an integration of technological skills, critical thinking, problem-solving ability, creativity and social awareness. However in Vietnam, research on the digital competence of school students remains limited, with most studies focusing on assessing the extent of information technology use or the effectiveness of online teaching in the post-COVID-19 period. The research gap lies in the lack of systematic analyses of the factors influencing the development of students' digital competence, particularly from a multidimensional approach that integrates school-related, family-related, individual and societal factors.

From this reality, the present study was conducted at several high schools in Ho Chi Minh City to address the research question: Which factors influence the development of high school students' digital competence and to what extent does each factor have an impact? The study employed a mixed-methods approach, combining large-scale questionnaire surveys with in-depth interviews to ensure the collection of both quantitative data and qualitative insights for a deeper understanding of the observed phenomena. The initial findings identified the key factors influencing the digital competence of high school students, thereby contributing to proposals for creating effective digital learning environments and promoting the sustainable development of digital competence among high school students in the context of modern education.

2. Research methodology

To clarify the factors influencing the development of digital competence among high school students in the context of educational

digital transformation, this study employed a combination of qualitative and quantitative research methods, specifically as follows:

- *Theoretical research method:* This method was applied through the collection, analysis and synthesis of both domestic and international scholarly literature related to digital competence, including widely recognized frameworks such as DigComp, UNESCO's ICT-CFT and PISA 2025 as well as studies on factors affecting the digital competence of high school students. The purpose of this method was to systematize the theoretical foundations, construct the conceptual framework and analytical criteria and provide a scientific basis for selecting research instruments and interpreting the findings.

- *Semi-structured interview method:* A semi-structured interview method was conducted with several teachers and students at three high schools in Ho Chi Minh City. The implementation process included: (1) developing an interview guide focusing on factor groups such as the learning environment, family support, peer influence and the practical implementation of digital education at schools; (2) conducting face-to-face interviews with audio recording and note-taking and (3) coding and analyzing the content. This method was employed to collect qualitative data to complement, explain and deepen the quantitative results, as well as to identify latent factors that may not have been fully captured by the questionnaire.

- *Document analysis method:* The document analysis method was applied through the collection and examination of internal school documents, such as technology development plans, professional reports, technology equipment inventories, partnership programs with enterprises and extracurricular educational activities. This approach enabled the verification and cross-referencing of survey and interview data with the actual conditions in the schools, thereby providing an objective assessment of the

infrastructure, policies and resources that support the development of students' digital competence.

- *Questionnaire survey method*: This method was used to analyze survey data collected from students. The primary data collection instrument was a questionnaire designed to include items on groups of influencing factors, measured using a five-point Likert scale. The data were processed using SPSS software version 22.0, employing descriptive statistical techniques (frequency, mean and standard deviation) to determine the degree of influence and the corresponding level of difficulty associated with each factor for students.

+ *Survey participants*: Teachers and students at high schools in Ho Chi Minh City.

+ *Research sites*: Public high schools in Ho Chi Minh City. The selected institutions included Vo Truong Toan high school (a national standard school), Thanh Loc high school and the Vocational Education and Continuing Education Center of District 12. The selection was based on criteria related to the school system and educational quality to ensure objectivity in the research.

+ *Research sample*: According to the perspective of researchers such as Hair, Black, Babin, et al. (2010), to ensure reliability for Exploratory factor analysis (EFA), the minimum sample size should be from 5 to 10 observations per measurement variable. Based on this principle, the formula for calculating the EFA sample size was applied as follows:

$n = 5 \times \text{number of measurement variables included in the EFA}$

Accordingly, the number of measurement variables included in the EFA for the teacher group was 14 and for the student group was 9. Thus, the minimum sample size required was 70 for teachers and 45 for students. In practice, the survey was conducted with a total research sample of 364 participants, comprising 80 teachers and 284 students, ensuring objectivity in the research results.

The integrated application of these methods ensures reliability, objectivity and depth in assessing the factors influencing the digital competence of high school students, thereby enabling the proposal of appropriate directions for the development of digital education in general schools.

3. Research results

3.1. Overview of the digital competence of high school students and its influencing factors

3.1.1. The digital competence of high school students

The concept of digital competence was initially understood under the term “digital literacy.” According to Aviram and Eshet-Alkalai (2006), digital literacy is a combination of technical skills, cognitive skills and socio-emotional skills. UNESCO (2011) also defined “digital literacy” as the ability to use information and communication technologies to search for, evaluate, use and create information effectively in order to achieve goals in learning, work and participation in society. According to the Ministry of Education and Training (2025), digital competence is the ability to use technology to accomplish specific tasks or to solve practical problems.

In studying the digital competence of high school students, Nguyen Bao Quoc (2024) stated that digital competence in this context refers to the ability to use, operate and integrate digital devices and technologies confidently, with critical thinking and responsibility, in order to support learning and actively participate in social life. Thus, the digital competence of high school students is an integrated capability that combines knowledge, skills and attitudes in the responsible, effective and creative use of information and communication technologies to serve learning, communication, problem-solving and personal development in the digital environment. A digital competence framework is a structured system comprising groups of digital competences designed to guide and assess the

level of digital competence development of individuals or organizations. Globally, the European Commission (2006) and UNESCO (2018) have proposed digital competence frameworks, which serve as reference foundations for developing similar frameworks for different target groups. In Vietnam, the Ministry of Education and Training (2025) has introduced a learner digital competence framework consisting of six competence domains with 24 sub-competences: (1) Data and information exploitation; (2) Communication and collaboration in digital environments; (3) Digital content creation; (4) Safety; (5) Problem-solving and (6) Artificial intelligence application.

3.1.2. Factors affecting high school students' digital competence

In the context of an increasingly profound digital transformation, digital competence has become one of the essential capabilities for high school students, serving not only their learning needs but also preparing them for active participation in the digital society. However, the formation and development of students' digital competence are influenced by various factors within the educational and social ecosystem. From a systems perspective, the development of digital competence is the result of complex interactions between individual factors and environmental factors (Ferrari, 2013; Vuorikari et al., 2016).

- School-related factors

The school plays a central role in the formation and development of students' digital competence by creating a digital learning environment and organizing technology-integrated educational activities. This group of factors includes: the learning environment and the school's role; educational policies and assessment frameworks and training programs, investment in equipment and digital learning resources. Specifically, integrating technology into the curriculum, investing in technological infrastructure and developing digital learning

activities are key elements that provide students with regular and systematic opportunities to practice, engage with and enhance their digital skills. In addition, teachers' professional competence, pedagogical methods and technological experience directly influence the effectiveness of implementing technology-integrated teaching programs. Furthermore, national education policies, digital competence frameworks such as DigComp and assessment criteria in PISA 2025 help guide the content, methods and objectives of digital competence training in a systematic and coherent manner (Ilomäki et al., 2011). Thus, school-related factors not only provide learning conditions but also create motivation, environments and orientations for the development of students' digital competence.

- Family-related factors

The family is the first social environment and serves as a foundational factor in supporting students to form and develop digital competence. This group comprises two main factors: (1) the family's socio-economic conditions and place of residence and (2) the level of technological support provided by parents. Household income, parents' educational attainment and the area of residence (urban or rural) directly affect students' access to technological devices, internet connectivity and personal learning spaces. Research has shown that students in urban areas generally have higher digital competence than those in rural areas due to better infrastructure conditions and higher levels of technology adoption (Silva Quiroz & Morales-Morgado, 2022; Zhao, 2021). Moreover, parental support in guiding, supervising or encouraging students to use technology for learning also has a positive impact on the development of digital skills (Lilina & Miltuze, 2022). Therefore, the role of the family extends beyond material provision to include orienting and fostering students' positive digital learning behaviors.

- Learner-related factors

The student is the central subject in the process of developing digital competence. This group of factors includes: perceptions and attitudes toward technology; technological skills and prior experience; self-learning ability and self-management; self-efficacy and intrinsic motivation and problem-solving skills and critical thinking. First, a positive attitude, belief in the value of learning and clearly defined learning goals are prerequisites for students to actively engage with and use technology effectively (Wolters et al., 1996; Pintrich, 1999). Next, prior technological experiences-such as studying Informatics, using a personal computer or applying digital learning platforms-have a significant impact on the ability to utilize technology in current learning activities (Kim et al., 2018; Zhao et al., 2021). Self-learning ability and self-management-demonstrated through planning and monitoring learning progress-play a predictive role in the strategic and effective use of digital tools (Galindo-Dominguez & Bezanilla, 2021). In addition, confidence in one’s technological capabilities and intrinsic motivation (curiosity, interest, persistence) stimulate active and creative learning behaviors in digital environments (Shopova, 2014; Prior et al., 2016). Finally, problem-solving skills and critical thinking enable students to use technology not only at the level of technical operations but also in the

analysis, evaluation and creation of new knowledge (Blanc et al., 2025). Thus, learners’ internal factors directly determine their ability to acquire, develop and master digital competence.

- Society-related factors:

The social context serves both as a stimulus and as an environment influencing the process of developing students’ digital competence. In this study, the most notable factor in this group is the impact of the COVID-19 pandemic. This event triggered an abrupt shift from traditional learning to online learning, thereby increasing students’ frequency of engagement with digital technologies. However, alongside the opportunities for extensive exposure to technology, the pandemic also posed significant challenges such as psychological stress, lack of timely support and disparities in learning conditions-particularly between students in different geographical areas. This resulted in a portion of students perceiving their own digital competence as lower, despite a substantial increase in their exposure to technology (Lilina & Miltuze, 2022). Thus, social factors exert a strong influence on learners’ motivation, psychological state and technology-use behaviors, especially in context-specific transitions of historical significance.

3.2. Factors influencing the development of digital competence among high school students in Ho Chi Minh City

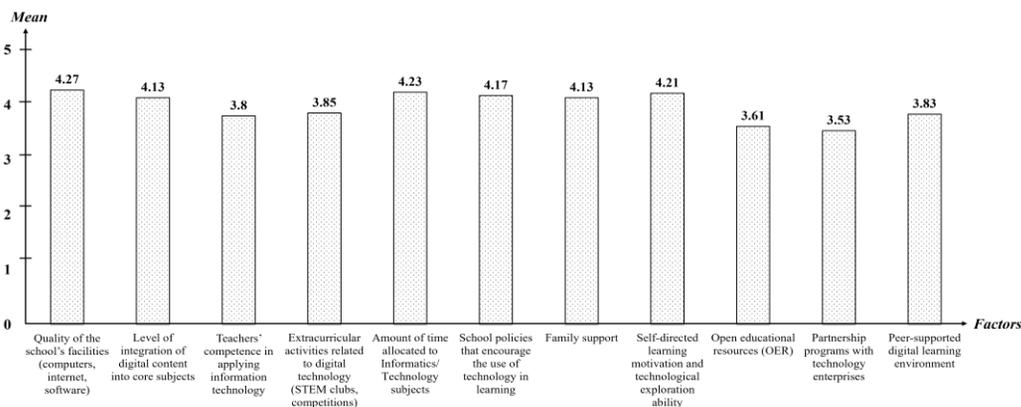


Figure 1. The factors influencing the development of digital competence among high school students in Ho Chi Minh City

To assess the importance of factors influencing the development of digital competence among high school students in Ho Chi Minh City, a survey was conducted with 284 students and 80 teachers using a five-point Likert scale ranging from 1 - Not important to 5 - Very important. The results are presented in figure 1.

3.2.1. School-related factors

The school plays a pivotal role in shaping

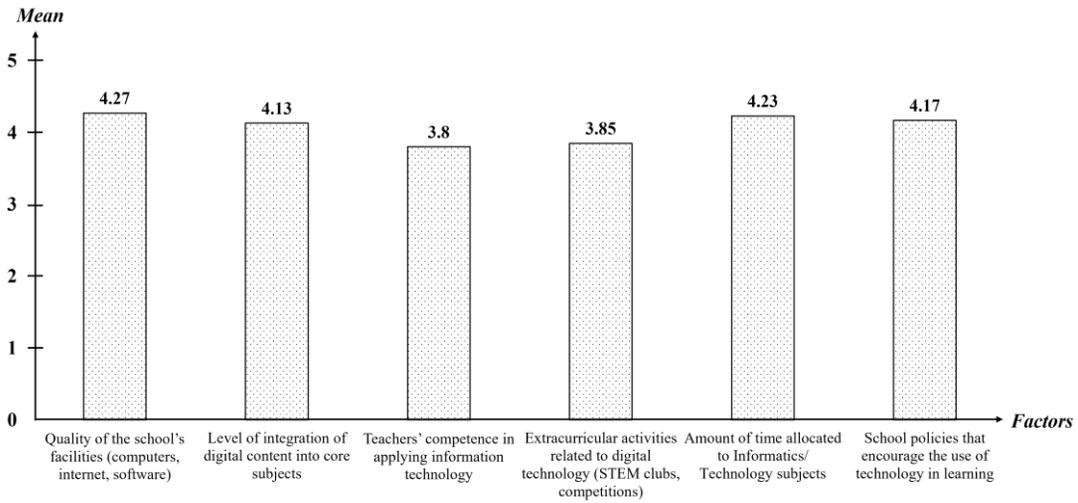


Figure 2. The extent of the influence of factors on the development of digital competence among high school students in Ho Chi Minh City

The survey results of students from three high schools in District 12 indicate that school-related factors have a moderate to very high level of influence with $M = 3.80 - 4.27$. Among these “Quality of facilities (computers, internet, software)” received the highest score ($M=4.27$), reflecting the foundational role of technological infrastructure in ensuring the effectiveness of digital learning. This finding is reinforced by data from the document analysis, which showed that all the surveyed schools have classrooms equipped with televisions, projectors, internet access and between 150 and 196 computers dedicated to teaching Informatics.

The factors “Time allocated for Informatics/Technology subjects” ($M = 4.23$) and “Policies encouraging the use of technology in learning” ($M = 4.17$) were rated highly, indicating the positive influence of curriculum

and developing students’ digital competence, not only as a formal educational environment but also as the entity responsible for organizing, implementing and ensuring the conditions for digital learning. A survey assessing the extent to which school-related factors influence the development of digital competence among high school students in District 12, Ho Chi Minh City, is presented in figure 2.

orientation and school-level mechanisms. In practice, all three schools have strategic plans for the 2021-2025 period that emphasize the application of information technology and smart education, demonstrating the alignment between learners’ perceptions and educational management orientations.

The “Level of integration of digital content into core subjects” ($M = 4.13$) also reflects the effectiveness of technology implementation in teaching. However, the remaining two factors “Teachers’ competence in applying information and communication technology (ICT)” ($M = 3.80$) and “Extracurricular activities related to digital technology (STEM clubs, competitions)” ($M = 3.85$) received lower scores, indicating certain practical limitations. Although the teaching staff at these schools meet professional standards with over 80% rated at a good level or higher,

the extent of extracurricular activities such as STEM programs and scientific research remains inconsistent, particularly at the Vocational and Continuing education center, where such activities are still limited. To further elucidate the above results, it is necessary to conduct a detailed analysis of the conditions for developing digital competence in public high schools in District 12 from each specific perspective:

- *Management of educational activities:* All three educational institutions have developed plans for the integration and implementation of educational activities incorporating information technology, reflecting an orientation toward smart education. These plans go beyond merely integrating technology into teaching as they are also linked to long-term development strategies that ensure alignment between management and instructional organization. This reflects an inevitable trend in the context of digital transformation in education, where management is regarded as the foundation for promoting pedagogical innovation and enhancing educational quality.

- *Teaching staff:* The teachers at these institutions all meet professional standards with a high proportion rated at good or above and actively participate in continuous professional development as well as the integration of information technology into their teaching. Their competence in organizing experiential activities, career guidance and scientific research is demonstrated through various forms, contributing to the development of students' digital competence. Maintaining and enhancing the quality of the teaching staff is a key factor, providing the foundation for the effective implementation of educational programs aligned with innovation-oriented approaches.

- *Facilities - classrooms and specialized rooms:* The facilities at all three institutions are

relatively well-standardized with permanent classrooms equipped with modern teaching aids such as smart TVs, projectors, sound systems and internet connectivity. Computer labs are fully equipped with a sufficient number of computers to meet learning demands, along with specialized subject rooms that support a wide range of teaching and learning activities. These conditions provide a favorable environment for implementing technology-integrated activities and fostering the development of digital competence.

- *Teaching equipment:* All institutions meet the minimum requirements for teaching equipment with computer systems fully equipped with internet connectivity. Some institutions demonstrate strengths in teachers' effective use of equipment and teaching aids, although the level of creative investment in self-developed teaching tools remains uneven. The presence and effective utilization of digital teaching resources serve as a direct enabler for pedagogical innovation and for enhancing students' access to knowledge.

- *Library:* The libraries at all three institutions meet established standards and are equipped with computers connected to the internet, enabling both students and teachers to access a wide range of learning resources. However, a common limitation is the absence of an electronic library management system, which restricts the utilization, searchability and management of digital resources. The addition and integration of an electronic library system would enhance usage efficiency and better meet the requirements for developing digital competence.

- *Other educational activities:* All institutions organize a variety of supplementary educational activities such as life skills training, career-oriented experiential learning, scientific research, STEM initiatives and the design of E-Learning lessons. These activities not only enable students to apply knowledge in real-world contexts but

also provide an environment for developing digital skills and other 21st-century competencies. Although the extent of implementation varies, there is a shared recognition of the importance of supplementary activities in fostering the holistic development of students.

- *Student clubs*: Each institution maintains student club activities with themes related to the application of technology and the development of creative competencies, such as STEM clubs, media clubs or cultural and arts clubs. These clubs serve as extended learning environments beyond the classroom, enabling students to practice collaboration skills, problem-solving abilities and effective use of technology, thereby contributing to the enhancement of their digital competence and personal qualities.

Thus, schools play a core and multidimensional role in developing students' digital competence. The integration of technical infrastructure, curricula, management policies and staff capacity forms a solid foundation for building an effective and sustainable digital learning environment. This serves as a critical leverage point for enhancing educational quality in the context of the current comprehensive digital transformation.

3.2.2. *Family factors*

The family is the primary social environment that directly influences the formation and development of students' digital competence. In this study, the representative factor for the family group is parental support in technology-based learning, which includes providing learning devices, ensuring internet access, offering guidance and encouraging students to use technology for educational purposes. This factor functions both as a "material resource" and as a "psychological resource," contributing to the promotion of positive digital learning behaviors among students.

The survey results presented in Figure 2 indicate that the factor "Family support" attained an average score of 4.13, demonstrating that students clearly recognize the practical role of the family in supporting digital learning. However, the difficulty level of the factor "lack of learning devices at home" was only $M = 2.62$, reflecting the reality that the majority of students in the surveyed area already have relatively stable access to digital devices and this difficulty is no longer prevalent at a high level.

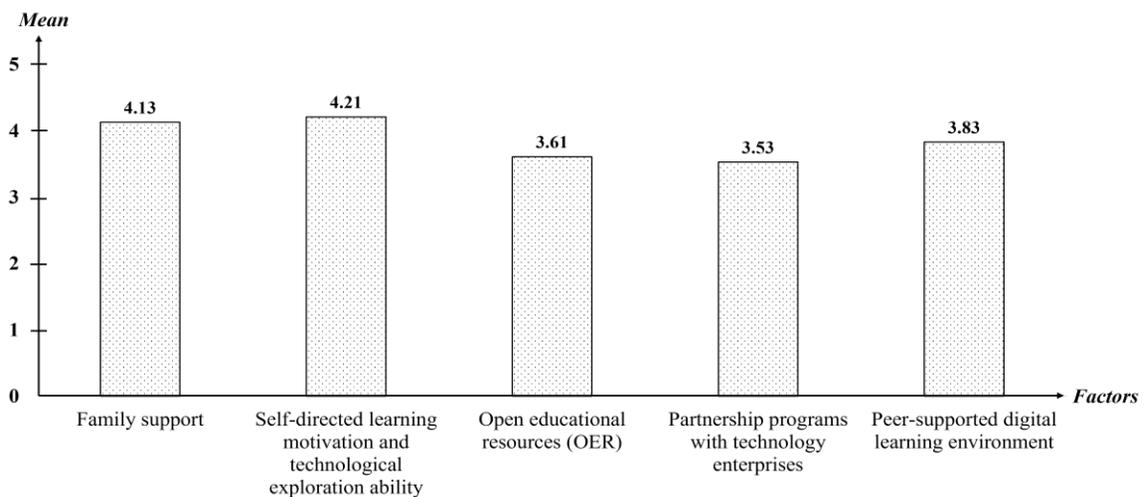


Figure 3. The extent of the influence of factors on the development of digital competence among high school students in Ho Chi Minh City

The interview results with students at educational institutions in the surveyed area reveal that families play an important role in providing resources and encouraging learning motivation. A 12th-grade student shared “My parents supported me in buying a smartphone in Grade 10 to facilitate online learning” (HS1). Another student added “My parents regularly remind me about my studies when they receive assignment notifications from teachers” (HS2). These statements reflect parental involvement not only in equipping students with learning devices but also in closely monitoring the learning process through communication channels from the school.

In addition to the positive support provided, interview results with teachers indicate that there remains a gap in the collaboration between families and schools in guiding students’ use of technology. A homeroom teacher observed, “Parents nowadays mainly provide devices but the coordination in monitoring students’ use of technology is still limited, especially in classes with many male students” (GV1). This statement highlights that while material support has been prioritized, the guidance and supervision of how students use technology have not been implemented consistently. This underscores the need for families to work alongside schools in both aspects-providing material resources and directing digital learning behaviors-to ensure that the development of students’ digital competence is comprehensive and sustainable.

Family factors have a practical and positive influence on the development of students’ digital competence, particularly during the initial stages of technology adoption. Although family support does not directly involve teaching, it serves as both a “logistical and emotional foundation” enabling students to confidently access, utilize and apply technology in their learning effectively and sustainably. This foundation is crucial for narrowing the

digital divide and fostering equitable development among different student groups in the modern learning environment.

3.2.3. *Learner-related factors*

The learner is the central factor directly determining the formation and development of digital competence. Among these, students’ capabilities, self-directed learning motivation and technological exploration skills are considered clear indicators of their proactiveness and adaptability in a digital learning environment. The survey results on the influence level of these factors show that “Self-directed learning motivation and technological exploration ability” received a high average score (4.21), reflecting students’ self-awareness and positive tendencies in proactively accessing, using and leveraging technology for learning purposes. Many students demonstrated a strong interest in exploring new tools such as design software, presentation platforms and digital learning management systems without relying entirely on teacher guidance.

However, an analysis of the level of difficulty in digital learning across different educational institutions reveals notable differences among student groups. Specifically, students at Vo Truong Toan high school reported the lowest difficulty level ($M = 2.63$), followed by Thanh Loc high school ($M = 2.87$), with the highest level observed at the District 12 Center for Vocational Education and Continuing Education ($M = 2.95$). This indicates that variations in individual capabilities lead to differing degrees of difficulty in accessing technology. Students in high schools with stable learning conditions and stronger academic foundations tend to be more proactive and confident in using technology. In contrast, students at continuing education centers-characterized by average academic performance and uneven learning conditions-often face

greater challenges when required to engage in self-directed learning or work with digital tools.

During interviews with students at general education institutions within the study area, many reported proactively seeking out and using technological tools to support their learning. An 11th-grade student shared: “I often explore how to use software like Canva or Padlet because they are convenient and help me remember lessons better” (HS4). A 12th-grade student added: “As a senior, I often participate in online courses or take online practice tests to review and improve my academic performance” (HS7). These statements indicate that students not only acquire knowledge from formal classroom instruction but also leverage open educational resources and digital tools to expand the scope and methods of their learning, thereby enhancing their autonomy and effectiveness in exam preparation.

Alongside the proactivity demonstrated by some students, others expressed difficulties in accessing and utilizing technology. One student stated: “I want to learn how to make videos or do design work but I don’t know where to start, so sometimes I just lose motivation” (HS3). The perspective of an Information technology teacher further clarified the root cause: “Students are interested and motivated when participating in technology-related activities but without learning organization skills or basic technological foundations, they can easily give up midway when facing obstacles” (GV3). This indicates that although intrinsic motivation plays a vital role, effective development of digital competence requires students to be systematically equipped with self-directed learning skills, basic technological proficiency and problem-solving thinking.

In summary, learner-related factors have a significant influence on the development of digital competence. However, the observed disparities in difficulty levels among the three

student groups suggest that differences in foundational competence and readiness in digital learning skills are decisive factors affecting the effectiveness of technology adoption. This provides an important basis for schools and teachers to design differentiated support programs tailored to specific student groups in the process of implementing digital transformation in education.

3.2.4. *Social factors*

In this study, the category of social factors is broadened to encompass not only macro-level policies but also elements within the open educational ecosystem, such as technology enterprises, peer learning communities and publicly accessible digital learning resources. Although these factors do not directly belong to the school or family domain, they exert a profound influence on the development of students’ digital competence by expanding opportunities for technology access, enhancing social interaction and fostering positive learning behaviors.

From the survey results shown in figure 2, the “Digital learning environment from peers” emerged as the most influential factor in this group ($M = 3.83$). This factor reflects the positive impact of peer-to-peer interaction in technology-based learning-where students share resources, provide technical support, explore new tools together or collaborate on digital platforms. A 12th-grade student shared: “We often work on assignments together using Canva or create groups to support each other” (HS6). Similarly, a teacher observed: “Some groups of students provide excellent technological support to each other, even forming groups to share digital learning resources via Zalo or Google Drive” (GV7). These examples illustrate that close social influence from peers plays a significant role in fostering a positive digital learning environment and encouraging the natural integration of technology into the learning process. In addition, the factor of “Open educational resources” such as MOOCs and digital libraries, was rated relatively

high by students, with $M = 3.61$. Although not part of the formal curriculum, platforms such as Viettel Study, Hocmai.vn, Facebook, TikTok and academic YouTube channels are utilized by students as supplementary reference sources.

Through in-depth interviews, many students demonstrated a tendency to actively seek and utilize learning resources beyond the school context. A 12th-grade student shared: “I often study additional Math lessons on YouTube and find advanced exercises on websites to better prepare for exams” (HS2). Another student added: “During exam preparation, I usually watch teachers’ livestreams on TikTok and Facebook for review, which has helped improve my academic performance” (HS5). These statements indicate that students do not confine themselves to the learning resources provided by the school but actively engage with open educational resources from society, thereby extending their learning environment beyond the traditional classroom. This serves as clear evidence of the trend toward diverse and flexible learning in the context of digital transformation.

In contrast, survey data indicate that the factor “Partnership programs with technology enterprises” was rated by students at a moderate level of influence, with $M = 3.53$ the lowest within the group. Some students noted that such collaborative activities are neither frequent nor sufficiently substantive. For example, one student remarked: “The school organized a career counseling session hosted by a company but it was mainly about introducing their products rather than offering any specific hands-on technology experience” (HS4). This suggests that, although technology enterprises hold significant potential to support education, the implementation of partnerships in high schools remains limited, often stopping at information-

sharing rather than designing practical, experiential technology activities for students.

Overall, the group of social factors has a significant impact on the development of students’ digital competence by fostering an open learning environment, enhancing social interaction and providing learning resources beyond the school context. Among these, the influence of peer interactions and open educational resources has been clearly demonstrated, while the potential of leveraging partnerships with technology enterprises remains underutilized. This underscores the need to expand collaboration between schools and social stakeholders to build a more comprehensive, effective and sustainable digital education ecosystem in the future.

4. Conclusion

The preliminary findings of this study identified four groups of factors influencing the development of digital competence among upper secondary school students: the school, the family, the learner and society. Among these, school-related factors play a pivotal role through technological infrastructure, digital teaching policies and teacher competence. The study’s limitations include its narrow survey scope, limited participant diversity and a short data collection period. Furthermore, it did not examine the influence of gender, family background or the specific impacts of various factors on high school students’ digital competence. Future research should expand the survey, diversify participant groups and apply regression analysis to measure the extent of each factor’s impact on digital competence development. In addition, experimental intervention models should be implemented to promote the comprehensive development of students’ digital competence.

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