

Evaluating Factors Affecting The Development Of Digital Competence For High School Students In Geography Teaching In Thai Nguyen Province, Vietnam

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Abstract

In the context of robust digital transformation, developing digital competence for high school students has become an urgent requirement to meet the goals of educational innovation and effectively implement the 2018 General Education Program. This article focuses on assessing the current status of factors affecting the development of students' digital competence in teaching Geography at high schools in Thai Nguyen province. The study employs methods of document analysis, questionnaire surveys administered to teachers and students, combined with statistical analysis, comparison, and data synthesis to elucidate the research objectives. The results indicate that the perception of teachers, students, and school administrators regarding the role of digital competence is relatively positive; however, the application of specialized digital tools remains significantly limited. Concurrently, there is still a noticeable disparity in implementation conditions across different regions.

Keywords: Digital competence, Geography teaching, High school, Digital transformation, Thai Nguyen province.

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I. Introduction

In the context of the Fourth Industrial Revolution and the global digital transformation process, developing digital competence has become one of the core requirements of modern education. In Vietnam, digital transformation in education is identified as one of the key tasks to improve teaching quality, innovate educational methodologies, and meet the demand for high-quality human resource training in the era of integration. The 2018 General Education Program is oriented toward developing learners' qualities and competencies, in which the formation and development of digital competence are considered vital conditions to help students learn effectively, adapt to digital environments, and meet the requirements of a knowledge-based society.

For Geography at the high school level, the robust advancement of geospatial technologies, Geographic Information Systems (GIS), remote sensing, digital maps, open data, and online learning platforms has induced fundamental changes in the organization of teaching and learning. Effectively exploiting digital technologies not only assists students in accessing geographical knowledge visually and vividly but also contributes to developing spatial thinking, data analysis skills, problem-solving capacities, and the application of knowledge into practice. Therefore, developing digital competence in Geography teaching is no longer a mere trend but has become an inevitable requirement to effectively achieve the goals of general education innovation.

In recent years, numerous domestic and international studies have addressed digital competence, digital transformation in education, and the application of information technology in teaching. However, most studies have focused on constructing digital competence frameworks, assessing digital transformation readiness, or researching technology applications within the general scope of education. Studies delving deeply into the development of digital competence specifically in teaching high school Geography remain relatively limited, particularly those tied to the practical conditions of specific localities. For Thai Nguyen province, although digital transformation in education has achieved many positive results, there are few systematic studies evaluating the factors influencing the development of students' digital competence in Geography teaching, as well as proposing solutions suitable for the local infrastructure, teaching staff, and regional characteristics.

Driven by these practical requirements, this article focuses on analyzing the theoretical foundations of digital competence development in Geography teaching; surveying and evaluating the current state of perception and digital technology application levels of teachers and students, infrastructure conditions, as well as difficulties during implementation at several high schools in Thai Nguyen province. The research findings indicate that teachers, students, and administrators possess positive perceptions regarding the role of digital competence in Geography teaching; however, the proficiency level in specialized digital tools, particularly GIS

software and geospatial technologies, remains limited. The study also points out a significant disparity in implementation conditions between central areas and disadvantaged regions, while identifying major barriers related to technological infrastructure, teachers' digital capacity, and teaching organization conditions. On this basis, the article proposes a system of feasible solutions to enhance digital competence for students in teaching Geography, contributing to meeting the requirements of educational digital transformation in the current period.

II. Data And Research Methods

1. Research Data

The study was conducted based on a combination of both secondary and primary data to ensure objectivity, comprehensiveness, and the reliability of research results. Secondary data sources were collected from strategies, programs, reports, and documents of the Ministry of Education and Training, the Department of Education and Training of Thai Nguyen province, and relevant educational management agencies. At the same time, the authors inherited and analyzed domestic and international research works on digital competence, digital transformation in education, learner competence development, and the application of digital technology in Geography teaching. Exploiting official literature and prior research results helped establish the theoretical framework, identify research gaps, and serve as a baseline to analyze and evaluate the current status of factors influencing the development of digital competence for high school students in Geography teaching within Thai Nguyen province.

In addition, the study utilized primary data collected through questionnaire surveys administered to 200 students in grades 10 and 11 at Song Cong High School and 30 teachers at the Viet Bac High School for Ethnic Minorities in Thai Nguyen province. The survey content focused on clusters of issues including: perceptions of the role of digital competence in Geography teaching; proficiency levels in digital skills; the extent of digital technology application in teaching and learning processes; and the difficulties, limitations during implementation, and support needs of teachers and students. The collected data were aggregated, verified, and processed to serve the analysis and evaluation of the current state of factors affecting the development of digital competence for high school students in Thai Nguyen province.

2. Research Methods

To achieve the research objectives, the article synthesizes multiple research methods to ensure scientific validity and reliability.

- The method of data collection, analysis, and synthesis was used to systematize the theoretical framework of digital competence, digital competence development in education, and Geography teaching; simultaneously, it analyzed the guidelines and policies of the Party, State, Ministry of Education and Training, as well as relevant domestic and international studies. The outcome of this method provides an important foundation for building the theoretical framework and orienting the analysis and evaluation of factor impacts.
- The questionnaire survey method was deployed to collect information from teachers and students regarding their perceptions, proficiency levels in digital skills, ability to apply technology in Geography teaching, and difficulties encountered during implementation. The survey was conducted directly at selected educational institutions to ensure objectivity and reflect practical realities.
- Descriptive statistical methods were utilized to process the survey data. The statistical results are presented in tables to clearly reflect the current state of digital competence development among students and teachers.
- The analysis, comparison, and contrast method was employed to evaluate differences in perception, digital competence, and implementation conditions among surveyed groups as well as between regions with different socio-economic conditions within Thai Nguyen province. On this basis, the study identifies advantages, difficulties, causes of limitations, and priority issues to be resolved during the educational digital transformation process.
- The analysis-synthesis method was applied throughout the research process to integrate results from the theoretical framework, survey data, and local realities, thereby drawing scientific conclusions and evaluating the current status of factors affecting digital competence development for high school students in Geography teaching in Thai Nguyen province.

III. Results

1. Key Concepts

According to the 2018 General Education Program (Issued under Circular No. 32/2018/TT-BGDDT of the Ministry of Education and Training of Vietnam): "Competence is an individual attribute formed and developed through inherent potential and the process of learning and training, allowing a person to dynamically synthesize knowledge, skills, and other individual attributes such as interest, belief, and willpower, to successfully execute a certain type of activity and achieve desired results under specific conditions". [1]

According to the European Digital Competence Framework for Citizens (DigComp 2.2) (European Commission, 2022): "Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It encompasses information and data literacy, communication and collaboration, media literacy, digital content creation, safety, and problem solving". [2]

According to UNESCO (2018) in the ICT Competency Framework for Teachers and research by Ferrari, A. (2013): "Digital Competence Development is a systematic pedagogical process in which educators design learning situations and tasks that require learners to utilize digital tools to search, process, and generate new values. This process helps learners transition from a technical access stance to mastering a digital mindset". [11]

According to Bernd Weidenmann (2002) and Dr. Nguyen Cong Khanh (2019): "Competency-based Teaching is a instructional model that shifts the focus from equipping students with 'what they know' (content) to 'what they can do' (competence). In this model, learning activities are designed through practical tasks, encouraging learners to construct knowledge themselves. Furthermore, competency-based teaching is a model that focuses on maximizing the learner's potential, where competence is the synthesis of three elements: knowledge, skills, and attitudes. Thereby, the design of teaching and learning activities is intertwined and correlated to enable learners to demonstrate their actual learning capacity. From here, students can promote positivity, self-awareness, initiative, and a self-learning spirit to continuously improve their academic capacity". [3]

According to Le Thong (Editor-in-Chief) (2018) in Applications of GIS in Geography Teaching: "Subject-specific digital competence in Geography is the ability to apply specialized technologies (such as Geographic Information Systems - GIS, remote sensing, GPS, digital maps, and spatial data processing software) to collect, analyze, and present geographical phenomena". [3]

2. Digital competence in teaching Geography at High schools

The manifestation of digital competence in Geography is not simply the use of technological devices but the integration of specialized geographical knowledge with digital skills to solve problems. The detailed manifestations are presented according to the following component competence groups:

First, competence in exploiting and managing digital geographical data: The clearest manifestation of this competence is the students' ability to access, search, and filter information from reliable data sources on the internet. Instead of relying solely on textbooks, students possess the skills to extract data from the portals of the General Statistics Office, international organizations like the World Bank (WB), IMF, or climate change data from NASA. More importantly, students demonstrate critical thinking when contrasting and validating the authenticity of different information streams, knowing how to store and manage data files (texts, spreadsheets, satellite images) scientifically to serve long-term research and learning.

Second, competence in using specialized tools and information systems (GIS & Remote Sensing): This is the most subject-specific manifestation of Geography in the digital age. Students do not just recognize objects on paper maps but also master tools such as Google Earth, ArcGIS Online, or QGIS at a basic level. They know how to manipulate digital maps, such as zooming in/out to observe field details, measuring distances and areas, determining GPS coordinates, and particularly the ability of "layering maps" to analyze causal relationships. For instance, students know how to overlay a topography map onto a river network map to explain flow directions, or overlay a population map onto an economic map to analyze labor distribution.

Third, competence in processing, visualizing, and creating geographical content: The manifestation of this competence lies in students transforming raw data into meaningful and comprehensible information. Instead of dry data tables, students use auxiliary software to plot interactive charts, design vivid infographics, or edit short videos explaining local geographical issues. Using modern presentation tools and online design platforms (such as Canva, Piktochart) to professionally present learning project results with high aesthetic and logical value is clear evidence of developed digital content creation capabilities.

Fourth, competence in communicating, collaborating, and solving problems in a digital environment: In project-based learning, digital competence manifests through students proficiently using online teamwork tools like Google Workspace and MS Teams to discuss, share documents, and execute common tasks. Students know how to behave civilly, complying with ethical rules and information security when participating in geography learning forums. In particular, when facing a practical issue (e.g., proposing solutions to mitigate pollution in a river in Thai Nguyen), students know how to use simulation software or digital tools to calculate, forecast, and provide solutions based on gathered scientific data.

3. Evaluating factors affecting the development of digital competence for High school students in Geography teaching

Teachers' perception of digital competence development

Teachers' perception is considered the factor that directly determines the success of educational innovation. In teaching high school Geography, perception of digital competence does not stop at understanding technical tools but also encompasses grasping the structure, meaning, and methods of transforming digital skills into professional competence for students. The majority of local Geography teachers have had initial exposure to the concept of digital competence through training sessions on the 2018 General Education Program and directive documents from the Thai Nguyen Department of Education and Training.

However, the level of perception still shows significant divergence. A segment of teachers, particularly the younger cohort, perceive digital competence as a multi-dimensional system including: the ability to exploit spatial data, skills in using specialized software (such as GIS, Google Earth), and awareness of information safety. Conversely, some senior teachers still equate digital competence with basic "office computing skills" or using PowerPoint presentations in teaching. This inconsistent understanding of the connotation of digital competence leads to the implementation of technology-integrated teaching activities being occasionally formalistic, failing to penetrate the essence of digital geographical thinking. [5]

Most Geography teachers affirm that developing digital competence is an urgent and vital requirement in the current context. This realization stems from the subject matter itself—a discipline naturally bound to dynamically changing spatial data layers. Teachers recognize that without digital competence, students will find it difficult to achieve the required outcomes of the new program, especially sections on cartography, remote sensing, and economic geography. Digital competence not only helps students excel in Geography but also provides opportunities to adapt to the future labor market in a locality driving industrialization and modernization like Thai Nguyen.

Practically, teachers have realized they are no longer the sole "source of information" but must act as coordinators and guides for students to exploit digital resources. Teachers' readiness to innovate is demonstrated through active participation in digital lesson design competitions and applying digital learning materials into classroom realities. However, perception regarding technological autonomy remains a barrier. Some teachers, despite understanding the benefits of tools like ArcGIS, remain hesitant due to fear of not mastering technical incidents in class or lacking specific instructional materials tied to local realities. According to the summary report of the Thai Nguyen Department of Education and Training, teachers' awareness of digital transformation increased sharply after the COVID-19 pandemic, but deeper intervention measures are still needed to transition from "awareness of necessity" to "awareness of effective implementation methods". [3]

A bright spot in the perception of Geography teachers in Thai Nguyen is the emphasis on cultural and safety aspects in the digital environment. Teachers realize that when letting students access the internet to search for geographical data, it is simultaneously necessary to educate them on copyright, citing official data sources, and information filtering skills. This is an essential component of digital competence that teachers identify as a moral education task integrated within the subject.

Students' perception of the role of digital competence

In the structure of competency-based teaching, learners' perception acts as an endogenous motivation, determining the attitude and level of effort in mastering knowledge. Through surveys and practical analysis at high schools in Thai Nguyen province, the current status of students' perception regarding the role of digital competence in Geography is expressed through the following facets:

- The majority of high school students today belong to the "Digital Natives" generation, possessing a natural sensitivity to technology. They have begun to perceive that learning Geography is no longer confined to memorizing numbers from textbooks or observing static paper maps. Students at schools such as Luong Ngoc Quyen High School and Chu Van An High School have recognized digital competence as a tool that helps them "expand the boundaries" of the classroom, allowing access to online data repositories, field observations via satellite images, and interaction with 3D spatial models. This perception helps students shift from passive learning to actively exploring knowledge via smart devices. [1]
- For high school students, the role of digital competence is most clearly felt through the ability to make geographical knowledge vivid and comprehensible. Students perceive that using applications like Google Earth, digital map systems (WebGIS), or natural phenomenon simulation software helps them clearly visualize the distribution of geographical objects and complex natural laws (such as atmospheric circulation, ocean currents, or tectonic plate movements). Acknowledging the superiority of technology over traditional methods is a key factor motivating students to develop digital manipulation skills.
- A segment of students, particularly those participating in learning projects, has recognized the role of digital competence in solving local practical problems. They understand that knowing how to collect, analyze, and

present digital data on the environment, population, or socio-economics of Thai Nguyen province serves not only the lesson but is also an important skill for solving community issues. [9]

However, reality also reveals a gap in students' perception regarding digital culture and ethics. While they are technically proficient (computer operations, searching information...), perception of personal data security, verifying the authenticity of geographic data sources on the internet, and respecting copyright remains limited. Many students still maintain the habit of copying online data without verification or clear citation of sources. This places a demand on teachers to orient a comprehensive perception of digital competence—not just "knowing how to use" but "using correctly" and "using responsibly". [4]

In general, the perception of high school students in Thai Nguyen regarding the role of digital competence in Geography has shown positive shifts, moving from viewing technology as an entertainment tool to a tool for learning and scientific research. However, the level of perception remains skewed toward technical aspects and varies among student groups. This is an important empirical basis for proposing pedagogical solutions to raise full and correct awareness for students, creating a prerequisite for developing specialized digital skills.

The author conducted a survey of 200 students (grades 10 and 11) at Song Cong High School, Thai Nguyen province. The results obtained are as follows:

- Awareness regarding the significance of digital competence: While most learners have developed an initial consciousness of the role of technology, the degree of prioritization is not uniformly distributed.

Table 1. Perception of the importance of digital competence

Assessment Level	Quantity (N=200)	Percentage (%)
Very important	84	42.0
Important	76	38.0
Normal	32	16.0
Low/Not important	8	4.0

Up to 80% of students evaluated digital competence at "Important" and "Very important" levels. This shows that the readiness of Song Cong High School students to embrace modern teaching methodologies is substantial.

- Learners' self-evaluation of digital skill proficiency: This serves as the most crucial section demonstrating the imperativeness of the study. Although cognitive awareness is substantial, practical execution capabilities are constrained.

Table 2. Students' self-assessment of proficiency in digital skills

Skill Group	Very weak/Weak (%)	Average (%)	Fair/Good (%)
Searching information on the Internet	5.5	30.5	64.0
Using interactive tools (Quizizz, Padlet)	15.0	45.0	40.0
Exploiting specialized software (GIS, Google Earth)	68.5	22.0	3.0
Processing data and plotting digital charts	42.0	38.0	20.0

The survey results reveal a paradox: students are very proficient at searching for information (64.0%) but very weak in using specialized geographical software (only 3.0% achieved a fair/good level). This proves that students "knowing how to use computers" does not equate to possessing "digital competence in Geography".

- Learners' awareness regarding the benefits of digital competence in education: There is an explicit expectation among students for a shift in learning modalities to mitigate monotony.

Table 3. Students' perception of the benefits of digital competence in learning

Expected Benefits	Mean Score (5-point scale)
Helps lessons become more visual and vivid	4.52
Trains skills for future career	4.38

Helps execute projects about the locality (Thai Nguyen)	4.15
Saves time on writing down theory	3.85

Survey data at Song Cong High School reflects an objective reality: students have positive attitudes and a desire to apply technology, but practical competence (especially GIS skills and spatial data processing) is very low. This is precisely the empirical "touchpoint" confirming the urgency of implementing the pedagogical solutions proposed by the author to bridge the gap between perception and practical execution skills for students. Some main barriers in developing students' digital competence include: students have not been specifically guided by teachers on how to use specialized software; infrastructure and internet connection at school are occasionally unstable; exam pressure forces them to prioritize rote memorization over digital practice.

Administrators' perception of promoting digital transformation in schools

The management team at high schools plays the role of creating mechanisms and leading change. Administrators' perception of digital transformation does not stop at supporting policies but must manifest through strategic vision in building a smart educational ecosystem. Through practical surveys in Thai Nguyen province, the current status of administrators' perception is clarified through the following aspects:

The majority of administrators at high schools in the province have clearly perceived that digital transformation is not a temporary "movement" but a core solution to improve educational quality, enhance school governance efficiency, and integrate with global educational trends. This high consensus is the prerequisite helping schools boldly shift from paper-based management to electronic management (electronic student profiles, digital signatures, electronic grade books), creating a transparent and scientific working environment. [9]

Administrators have correct perceptions regarding changing the pedagogical mindset for the teaching staff. Instead of imposing traditional assessment quotas, many principals have actively encouraged Geography teachers to apply new tools like GIS or project-based learning on digital platforms. This perception leads to the formation of timely reward and recognition mechanisms for digital educational initiatives. However, a segment of administrators in disadvantaged areas still perceives digital transformation from an "infrastructure-centric" view, meaning they only focus on purchasing computers without truly paying attention to promoting digital learning material exploitation and pedagogical innovation for teachers. [6]

Under limited school budget conditions, administrators' perception is demonstrated through investment priority choices. Reality shows that administrators have begun to care more about building shared digital repositories and equipping specialized copyrighted software (e.g., interactive Geography software packages) instead of merely investing in discrete hardware devices. This reflects a shift from "digitization" awareness to "digital transformation" — focusing on data value and connection processes rather than tangible devices. High school administrators in Thai Nguyen province also show special concern for narrowing the digital divide among student groups. They realize the school's responsibility in supporting disadvantaged students to access devices and ensuring information safety in a digitized school environment. [6]

To obtain a comprehensive assessment of digital pedagogical capacity, the above section presented survey results of 30 teachers at the Viet Bac High School for Ethnic Minorities. The findings reveal a noteworthy reality regarding technology application readiness of the pedagogical staff at this specialized school. Specifically, regarding the frequency of integrating digital technology into lessons, 13 teachers reported frequent use of online platforms and digital learning materials; 14 teachers used them occasionally, and 03 teachers still taught almost exclusively using traditional methods combined with paper maps.

When diving deeper into the level of proficiency in specialized digital tools for Geography, the divergence is highly pronounced:

- Presentation and classroom management tools (PowerPoint, Canva, Google Drive): Achieved the highest mastery rate with 86.7% (26/30 teachers) assessing themselves as proficient.
- Interactive and assessment software (Quizizz, Kahoot, Padlet): 56.7% (17 teachers) applied them well in warm-up or lesson consolidation activities.
- Map software and geospatial technology (Google Earth, ArcGIS StoryMaps, GIS systems): Only 20.0% (06/30 teachers) felt confident in exploiting them deeply to organize learning activities for students, while the remaining majority (80.0%) admitted to only knowing them theoretically or never having operated them directly.

Notably, when asked about the biggest barriers to developing digital competence for ethnic boarding students, 73.3% (22 teachers) agreed that the tight timeline of the new curriculum and the lack of specialized digital skill training courses are root causes; followed by 60.0% (18 teachers) expressing concern about the specific nature of boarding students who are not allowed to use personal devices (phones, laptops) freely,

making it difficult to assign homework in the form of digital projects. These empirical data indicate that although the teaching staff at Viet Bac High School for Ethnic Minorities has excellent pedagogical foundations and an innovative spirit, they still lack "supports" in terms of specialized skills and flexible organizational mechanisms to optimize digital competence for students. [6]

In summary, high school administrators' perception of promoting digital transformation in Thai Nguyen is comprehensive and highly practical. This correct understanding has created an internal regulatory framework and confidence for Geography teachers to implement solutions for student digital competence development. Nonetheless, for this process to take place synchronously, administrators need regular exposure to modern smart school governance models to optimize the interaction between technology and people in teaching.

Current status of infrastructure and digital competence of the teaching staff

Current status of infrastructure and IT infrastructure in schools

Infrastructure and IT systems are considered factors defining the execution limits of digital competence development solutions. For Geography—a discipline requiring robust support from visualization and spatial data processing tools—the current infrastructure state at high schools in Thai Nguyen province reflects the intersection between modernization investment and synchronization challenges.

Practical surveys show that most high schools in the province have been equipped with computer labs serving Informatics and multi-media learning activities. At key schools such as Thai Nguyen High School for the Gifted and Luong Ngoc Quyen High School, computer systems possess strong configurations sufficient to run specialized geography software. However, overall, the ratio of computers per student remains low compared to regular practice demands. Particularly, specialized supporting devices for Geography such as handheld GPS devices, smart interactive whiteboards, or tablets for experiential learning remain uncommon in many mountainous schools in Vo Nhai and Dinh Hoa. The lack of these devices restricts students' digital competence formation to "observation and simulation" on computers rather than "practice and experience" in a digital field environment. [8]

Thai Nguyen is one of the leading localities nationwide in digital transformation speed; therefore, 100% of high schools have fiber-optic internet connections. However, the problem lies in the coverage and stability of the Wi-Fi system within the school campus. A common reality is that internet connection is heavily concentrated in the administration block and computer labs, whereas in theoretical classrooms—where integrated teaching activities take place—the signal is often weak or unstable. This causes difficulties for teachers and students wishing to instantly access online digital map platforms like Google Earth, ArcGIS, or digital repositories of the Ministry of Education and Training. Network congestion during peak hours frequently occurs, disrupting collaborative learning projects and reducing the effectiveness of blended learning sessions. [10]

To date, 100% of high schools in central areas such as Thai Nguyen City and Song Cong City have high-speed Internet coverage (bandwidth over 100 Mbps) and are equipped with at least 02 standard computer labs with configurations that run geography software well like Google Earth or ArcGIS Pro. However, a significant decline is observed in mountainous and highland districts like Vo Nhai or Dinh Hoa, where the rate of computer labs with stable network connections reaches only about 65%, and on average, every 4 students share 1 computer device for practice during Geography classes. Surveying further into modern teaching support equipment, only about 35% of total regular classrooms across the province are integrated with smart interactive screens or multi-functional projectors, while the rate of subject classrooms (specialized labs for Geography) equipped with map digitization devices accounts for under 15%. This lack of hardware infrastructure synchronization acts as the largest technical barrier, directly impacting the progress and effectiveness of implementing comprehensive digital competence solutions for students. [10]

Finally, regarding maintenance and technical support. A practical barrier affecting implementation is the shortage of dedicated technical support staff at schools. When technological devices encounter incidents during Geography classes, troubleshooting is often delayed, causing hesitation among teachers to use technology. Besides, the budget for maintenance and periodic hardware upgrades at many schools remains tight, leading to deteriorated, slow-running computers that are incompatible with modern geographical software versions requiring substantial system resources. In conclusion, the current state of infrastructure and IT systems at high schools in Thai Nguyen province has met basic requirements but is not yet synchronous or specialized for developing geographical digital competence. To realize the goals of the 2018 Program, a more focused investment roadmap into specialized equipment and connection quality upgrades is required, creating a modern and reliable digital environment for both teachers and learners. [8]

Current status of digital competence among Geography teachers

The teaching staff is the central factor, playing the role of transforming curriculum goals into practical outcomes in learners. In the context of educational digital transformation in Thai Nguyen, Geography teachers'

digital competence does not stop at basic computing proficiency but requires a seamless integration among Content, Pedagogy, and Technology (TPACK).

Regarding the level of using basic IT tools and Web 2.0: Practical surveys indicate that almost all Geography teachers at high schools in Thai Nguyen have met standard IT skill requirements. Using office software (Word, Excel, PowerPoint) to draft lesson plans and design presentation slides has become a universal skill. Particularly after the online teaching phase coping with the pandemic, the majority of teachers mastered classroom management and online interaction platforms such as Microsoft Teams, Google Classroom, Zoom, as well as auxiliary tools like Kahoot, Quizizz, or Padlet. This demonstrates the high flexibility and adaptability of the local teaching staff before the demands of the digital age. [9]

Regarding competence in applying specialized software and geospatial technologies: This is a key element of subject-specific digital competence in Geography, yet it is also the aspect showing the clearest divergence. A segment of teachers, particularly core teachers and young teachers at key schools, have begun to effectively exploit Google Earth and simple WebGIS software to illustrate lessons. However, the proportion of teachers who can proficiently use advanced GIS software (such as ArcGIS, QGIS) to edit maps or analyze spatial data remains modest. Many teachers are still confused when processing remote sensing data or locating field coordinates. This limitation is partly due to the previous curriculum design being theory-heavy, and partly because teachers have not had access to advanced training courses on modern geographical techniques.

Reality shows that teachers have the ability to search for information on the internet very rapidly, but the skill to validate the reliability of geographic data remains a challenge. In Geography teaching, using unauthenticated statistics or maps can lead to deviations in scientific knowledge and political perspectives. Teachers in Thai Nguyen have become more aware of citing sources from Government portals, the General Statistics Office, or international organizations, but building a structured, distinct digital database for individual and professional organizations remains spontaneous and unsynchronized. [5]

Currently, the Geography teaching staff in Thai Nguyen province possesses a relatively good baseline of digital skills at a general education level but still lacks specialized skills specific to the discipline. To develop digital competence for students, it is first required to raise the competence threshold for teachers themselves, helping them become professional designers of digitized learning environments rather than mere tool users.

Disparity in implementation conditions across regions in Thai Nguyen province

Thai Nguyen is a province with a topography and socio-economic development level clearly stratified between the central urban area and high mountainous, remote regions. This characteristic creates a significant disparity in conditions for developing digital competence for students, forming objective "digital divides" among educational institutions within the same province.

In developed urban areas, high schools possess absolute advantages in infrastructure. Students here not only access high-configuration computer systems and school-wide broadband Wi-Fi but also have conditions to access personal smart devices at home. Conversely, in mountainous districts like Vo Nhai and Dinh Hoa, IT infrastructure in many schools remains minimal. Many school sites still face unstable internet connections due to fragmented terrain, or experience a shortage or obsolescence of computer lab equipment, failing to meet installation requirements for modern geographical software. This difference makes the implementation of advanced practical lessons unsynchronized, creating barriers right from the tool access stage.

Family economic conditions and living environments strongly impact students' perception and digital skills prior to entering high school. Urban students are often exposed to technological environments early, becoming proficient in computer operations, searching for information, and using mobile applications. Meanwhile, students in rural and mountainous areas, particularly ethnic minority students, often have fewer opportunities to interact with digital devices. Their digital capacity mostly stops at basic smartphone operations for entertainment purposes, leading to Geography teachers in these areas spending more time guiding foundational skills before moving into specialized content.

Schools in central areas are often where core teachers aggregate, having more opportunities for networking, training, and accessing modern educational trends. The competitive environment and high learning demands of urban students drive teachers to constantly self-cultivate digital capacity. Conversely, in remote areas, due to difficult travel conditions and lack of direct technical support, a segment of teachers still retains traditional teaching habits, showing less enthusiasm for applying complex technology. However, a positive note is that thanks to preferential policies of Thai Nguyen province, this gap is gradually narrowing through online training programs and device support for disadvantaged areas.

Regional differentiation also leads to differences in the demand for applying digital competence in Geography. Urban students tend to use digital competence to learn about urban planning, industrial geography, and services. Meanwhile, mountainous students have the terrain advantage to practice digital skills tied to physical geography, agriculture, forestry, and forest resource management through tools like GPS positioning or

field maps. Leveraging regional specificities to design appropriate learning activities is a necessary direction to mitigate the negative impacts of material condition disparities.

In short, regional disparity in implementation conditions in Thai Nguyen is an objective reality requiring digital competence development solutions to be flexible with appropriate roadmaps. Clearly identifying this differentiation helps the research topic provide practical pedagogical measures, ensuring fairness and effectiveness for all student demographics across the province.

IV. Conclusion

The study has elucidated the theoretical foundation and evaluated the current status of high school students' digital competence development in Geography teaching at several high schools in Thai Nguyen province. Results demonstrate that both teachers and students perceive the critical role of digital competence in teaching and learning; however, exploiting digital tools—especially software and geospatial technologies serving Geography teaching—remains highly limited due to gaps in technological infrastructure, teachers' digital capacity, and school implementation conditions.

The research findings open up requirements for further in-depth studies on subject-specific digital competence development models, as well as evaluating the effectiveness of digital transformation solutions in Geography teaching across regions with different socio-economic conditions. On this basis, the article proposes key solutions including: enhancing training in digital competence and geospatial technology applications for teachers; investing in and upgrading infrastructure and digital learning materials for teaching; innovating teaching methodologies toward increasing experience and digital data exploitation; and concurrently building a coordination mechanism among schools, educational management agencies, and related units to create a favorable environment for developing students' digital competence, contributing to improving Geography teaching quality and meeting digital transformation requirements in general education.

References

- [1]. Ministry Of Education And Training. (2018). General Education Curriculum: Master Curriculum And Geography Curriculum. Vietnam Education Publishing House.
- [2]. Ferrari, A. (2013). Digcomp: A Framework For Developing And Understanding Digital Competence In Europe. European Commission, Joint Research Centre.
- [3]. Le, T. (Ed.). (2018). Applications Of GIS In Geography Teaching. Pedagogical University Publishing House.
- [4]. Nguyen, C. K. (2021). Developing Digital Competence For Teachers And Students In The Context Of Educational Digital Transformation. Vietnam Journal Of Educational Sciences, (42), 15–20.
- [5]. Nguyen, V. C. (2020). Developing Digital Competence For Students In Teaching Geography At High Schools. Journal Of Education, Special Issue (October), 142–147.
- [6]. Thai Nguyen Department Of Education And Training. (2023a). Report No. 412/BC-SGDDT Summarizing The Tasks Of Information Technology Application And Digital Transformation In High School Education For The Academic Year 2022–2023.
- [7]. Thai Nguyen Department Of Education And Training. (2023b). Guidelines No. 2145/HD-SGDDT On Implementing Information Technology Application, Digital Transformation, And Educational Statistics Tasks For The Academic Year 2023–2024.
- [8]. Thai Nguyen Department Of Education And Training. (2024). Report On The Current State Of Infrastructure And Minimum Teaching Equipment For Implementing The 2018 General Education Program.
- [9]. Thai Nguyen Provincial Party Committee. (2020). Resolution No. 01-NQ/TU Dated December 31, 2020, On The Digital Transformation Program Of Thai Nguyen Province For The Period 2021–2025, Orientation To 2030.
- [10]. People's Committee Of Thai Nguyen Province. (2023). Report On The ICT Readiness Index Of Thai Nguyen Province In 2023.
- [11]. UNESCO. (2018). ICT Competency Framework For Teachers (Version 3). United Nations Educational, Scientific And Cultural Organization.