

TEACHERS' PERSPECTIVES ON USING ICT TO ENHANCE LEARNING OF CHALLENGING GEOGRAPHY TOPICS IN MALAYSIAN LOWER SECONDARY SCHOOLS

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Abstract

This study investigates teachers' perspectives on using Information and Communication Technology (ICT) to enhance the learning of challenging geography topics among lower secondary students in Malaysian schools. Using a qualitative survey approach, data were collected from 30 experienced geography teachers through open-ended questionnaires, and five teachers were interviewed in depth. The study identifies the geographical topics challenging for lower secondary students, with topography maps (26.7%), drainage systems (20%), and landforms in Southeast Asia (13.3%) emerging as the most problematic areas. It explores various ICT approaches employed by teachers, with mobile technologies (40%) and educational games (26.7%) followed by interactive whiteboards (20%). The study reveals that interactive videos, geospatial technologies like Google Earth, and gamification significantly enhance student interest and understanding of complex geographical concepts. The findings highlight the potential of ICT in transforming geography education, making it more engaging and accessible. This research provides important information for curriculum design, teacher training, and educational policy, emphasizing the need for systematic integration of appropriate technologies in geography education.

Keywords: ICT in Education, Geography Subject, Challenging Topics, Teacher Perspectives.

1. INTRODUCTION

The advancement of technology has led to the emergence of the Fourth Industrial Revolution, which focuses on innovations in Information and Communication Technology (ICT). This development provides a wealth of information that can be accessed by teachers and students without boundary and time constraints. Information is more easily explored and obtained at one's fingertips. Through ICT, online learning can be facilitated by teachers using platforms such as Google Meet, Google Classroom, and Zoom.

This allows students to attend classes virtually from any location and at any time. The Malaysian Ministry of Education prioritized this skill among students and teachers during the Covid-19 pandemic. This approach has given students many opportunities to communicate with teachers outside of class hours and is not limited to specific times. The flexible teaching and learning process has positively impacted the national education system (Sufian et al., 2020).

Since digital technology was introduced, its role has expanded significantly, especially in addressing the challenges of 21st-century learning. For instance, Geographic Information Systems (GIS), which involve computer-based mapping, require that teaching and learning in this subject keep up with current trends and developments to avoid becoming outdated.

ICT applications can assist in delivering engaging lessons and achieving learning objectives. For example, the use of Google Earth in geography lessons has been shown to capture students' interest and enhance their achievement (Talip & Sobri, 2013). The use of terrain models in this subject also greatly aids in improving students' understanding (Putri & Sriyanto, 2022).

Additionally, the use of videos in learning is more effective compared to textbooks (Ishak & Khalid, 2021), which is particularly relevant given that many lower secondary students face difficulties in understanding topics and complex geographic concepts (Xiang & Liu, 2017). These difficulties can affect students' interest and performance in the subject. Therefore, the use of technology in geography education has shown great potential to overcome these challenges.

The use of ICT can help students better understand the physical world and human-environmental relationships. For example, technologies such as Geographic Information Systems (GIS), virtual reality, and interactive applications can visualize geographic concepts more clearly and engagingly (Kerski, 2015). This allows students to experience geographic phenomena 'hands-on' even while in the classroom.

The ICT approach by teachers positively impacts students' comprehension of Geography. Mastery of technological skills helps geography teachers prepare for a future education system increasingly reliant on technology (Bednarz, Heffron & Huynh, 2013). With technological proficiency, teachers can be more proactive and efficient in their work, diversifying engaging teaching and learning activities.

Mastery of information technology skills is crucial in this digital age because it has transformed the way we live, work, learn, and communicate with others. This proficiency includes understanding information and communication technology (ICT), including computer networks and the internet (Talip & Sobri, 2013). Mastery of information technology skills in the 21st century can assist teachers in their daily tasks, such as data processing and communication.

2. LITERATURE REVIEW

In this modern digital era, technology has become an increasingly important tool in education, particularly in the teaching and learning of geography. Recent studies indicate that technology has significant potential to overcome the difficulties faced by lower secondary students in understanding topics and geographical concepts.

The difficulty in understanding geographical concepts among lower secondary students has long been recognized as a challenge in geography education (Gersmehl, 2014). Cox, Elen & Steegen (2017) found that the main findings reveal a rather poor general level of students' systems thinking ability for geography subject.

Students struggle to identify relationships between variables when various elements of systems thinking are involved, such as feedback loops, interactions between human and physical environment, and the combination of different sources of information.

Significant differences were observed based on the students' study background, as well as an interaction effect between the students' grade and gender.

Besides, Nwokoye, Umeh, & Mbeledogu, (2019) have identified several challenges in teaching and learning geography in Nigerian secondary schools. To address these issues, the proposed solution is GeoNaija, an educational mobile application platform designed to aid geography education. The application was developed using the ADDIE instructional design method, known for its popularity, ease of application, rapid prototyping capabilities, time efficiency, and provision of continual feedback.

This method involves cyclical and evolving phases of analysis, design, development, implementation, and evaluation. The GeoNaija app aims to make geography concepts easier, more captivating, and enjoyable for both students and teachers. The significance of this research was highlighted through a survey of 90 secondary students, who provided feedback on the app's presentation, visual appeal, navigation, and accessibility. The study confirmed that the mobile application would positively impact students' perspectives and help bridge the gap between conventional and informal education methods.

In schools, Information and Communication Technology (ICT) is relatively less emphasized in the teaching and learning of geography compared to subjects like mathematics and science. However, emphasizing ICT-assisted teaching in geography is crucial, given its significant role in the educational process.

ICT facilitates the communication of ideas through words, reports, and graphics. Students can present findings from fieldwork using software such as spreadsheets, word processors, and presentation tools to create graphs, tables, charts, and maps. ICT also enables students to collect, modify, process, and present data in various forms. For instance, in a field study focusing on river profiles, students gather data such as river flow velocity, sediment load, and dimensions (Potter, Niemitz & Sak, 2009).

The use of technology makes the subject of geography more engaging and relevant to study. The study by Artvinli (2017) is to investigate the role of Geographic Information Systems (GIS) in teaching geography and examines secondary school students' attitudes towards GIS, considering various influencing factors.

The study shows a 60% increase in students' interest in geography when various technological tools were used in teaching. Findings indicate that students have positive attitudes towards GIS, but new and more extensive applications are necessary to enhance their motivation and effectiveness in learning with GIS. Besides, there is a significant improvement in students' achievement scores when exposed to ICT, particularly by YouTube videos in physical geography subjects.

This indicates that instructional materials like YouTube videos can enhance performance and generate interest among students to learn Geography or other potentially engaging subjects. Studies show a positive impact on students' interest in Geography through YouTube applications (Rigdel & Rai, 2023).

In addition, mobile applications play an important role in enhancing geography learning. According to Kong (2012) and Rani (2021) integrating mobile devices in teaching has been shown to improve students' learning performance by increasing control, enhancing communication, and significantly boosting learning outcomes. This integration positively impacts students' motivation, meets learning needs, enhances interactions with tutors, and aids in assessments.

3. METHODOLOGY

This study uses an open-ended qualitative survey method. This method involves using a questionnaire containing open-ended questions to collect qualitative data, where respondents answer using their own words without predetermined answer choices (Singer & Couper, 2017).

This approach allows for the collection of in-depth data about geography teachers' experiences in teaching challenging topics and integrating technology into their teaching. The questions are designed to elicit detailed and descriptive answers, allowing researchers to explore this topic more deeply (Patton, 2015).

This method allows respondents to express their opinions more freely and potentially provide unexpected or unique information. Although this method also brings its own challenges because data analysis is time-consuming and complex, and the quality of answers greatly depends on respondents' willingness to provide detailed answers (Rea & Parker, 2014), these can be overcome through good cooperation from respondents.

The data collection process involves designing clear questions, distributing questionnaires, and giving respondents sufficient time to answer. In this study, the time allocated for each respondent is between 20 to 30 minutes to allow them to complete the given survey. A total of 30 geography teachers were selected through purposive sampling, allowing researchers to choose respondents who meet the desired criteria (Othman, 2013; Colonius, 2006).

The criteria set in the study are teachers who have more than 5 years of experience teaching geography and integrate the use of technology in their teaching. In addition, five experienced geography teachers were selected for in-depth interviews to support the findings from the survey conducted.

Data analysis in this study uses a thematic analysis or content analysis approach. Researchers identify themes or patterns that emerge from the answers, code and categorize the data, and make interpretations based on the identified themes (Terry et al., 2017).

Ethical aspects are also important in implementing this method, including ensuring respondents' confidentiality, obtaining informed consent, and giving respondents the option to withdraw or skip questions. To maintain confidentiality, especially for the five teachers interviewed, the researcher assigned pseudonyms such as Teacher 1, Teacher 2, Teacher 3, and so on, to ensure the anonymity of the participants involved in the study

4. FINDING

4.1 Challenging Topics in Geography among Lower Secondary Student

Table 1 shows the eight most challenging geography topics for lower secondary students, as identified through our research. These topics span various aspects of the geography curriculum and highlight areas where students commonly struggle with comprehension and application. The study shows that topographic maps are the most challenging for students, accounting for 26.7% of the total difficulties.

Topography map interpreting contour lines, understanding scale, grid and map interpretation pose significant hurdles for learners. On the topic of drainage in Malaysia, 20% of students stated that this subject is very challenging for them. Students are bound to textbooks without obtaining input from outside sources. Textbooks by themselves prove inadequate for students to fully grasp this subject matter. For example, during the interview, Teacher 2 stated, “In studying drainage, students tend to rely on memorization of facts without truly comprehending the underlying concepts”.

This leads to a widespread inability to effectively answer questions on the topic. A common issue is that students struggle to recall the names of Malaysian rivers and often mix them up with other waterways shown on maps. The core problem lies in the approach: students prioritize memorization over genuine understanding of the material they're studying. Besides the topic Landforms in Southeast Asia, 13.3% of students state that this topic is challenging to them. For this topic, the focus of discussion involves countries far from Malaysia, so students find it difficult to visualize the actual landforms of Asia.

Direction emerges as a challenging topic in Geography, with 13.3% of students reporting difficulties. According to Teacher 5, within this topic, students particularly struggle to master cardinal directions and bearing angles. Cardinal directions form the basis of spatial orientation, but students often find it hard to consistently apply these concepts, especially when working with differently oriented maps. Bearing angles, which require understanding of both directional concepts and basic geometry, present an even greater challenge for many students.

These difficulties likely stem from the abstract nature of these concepts and the need for students to mentally visualize spatial relationships, impacting their overall comprehension of geography and related skills like map reading and navigation. Water sources emerge as another significant challenge, representing 10% of the difficulties, likely due to the conceptual challenges of understanding various water bodies, groundwater systems, and the hydrological cycle.

The advancement of transportation in Asia and the issue of domestic waste each account for 6.7% of the challenges. Natural plants in Malaysia are also a challenging topic for students, as stated by 3.3%. In this topic, among the challenges for students are remembering the types and distribution of natural plants in Malaysia, and the factors that influence natural plant in Malaysia.

Table 1: Challenging Topics in Geography

Challenging Topics in Geography	Total	Percentage (%)
Topography map	8	26.7
Drainage in Malaysia	6	20.0
Direction	4	13.3
Landforms in Southeast Asia	4	13.3
Advancement of transportation in Asia	2	6.7
Water sources	3	10.0
Domestic waste	2	6.7
Natural plants in Malaysia	1	3.3
Total	30	100

4.2 ICT Approaches Used by Teachers Geography in Teaching

In recent years, the integration of Information and Communication Technology (ICT) in education has become increasingly prevalent, transforming traditional teaching methods across various subjects. Geography, a discipline that greatly benefits from visual and interactive learning, has seen a significant adoption of ICT approaches. A recent survey of 30 Geography teachers provides insight into the current landscape of ICT usage in the classroom.

The study reveals a clear preference for mobile technology, with smartphones and tablets leading the way in ICT adoption (Table 2). An impressive 40% of the surveyed teachers reported using these devices in their teaching practices. This trend likely stems from the ubiquity of mobile devices and their versatility in accessing a wide range of educational resources, apps, and tools that can enhance geographic learning.

Educational games emerge as the second most popular ICT approach, with 26.7% of teachers incorporating platforms like Kahoot and Quizizz into their lessons. This growing trend reflects the increasing recognition of gamification as an effective strategy to engage students and make learning more interactive and enjoyable. Interactive whiteboards hold the third position, used by 20% of the surveyed teachers.

According to Teacher 3, these tools offer a dynamic way to present geographic information, allowing for real-time manipulation of maps, diagrams, and other visual aids, which is particularly valuable in Geography education. More specialized technologies such as interactive videos and geospatial tools like Google Earth and Google Map are less frequently used, with each approach employed by only 6.7% of the teachers. This lower adoption rate may be attributed to factors such as limited access to these technologies, lack of training, or perhaps a perception that they are more complex to integrate into daily teaching practices.

The survey results paint a picture of a teaching landscape where readily accessible and user-friendly technologies are favored. Mobile devices and educational games, which are often familiar to both teachers and students, seem to have found a strong foothold in Geography classrooms. However, the limited use of more specialized geographic tools suggests there may be untapped potential.

Table 2: ICT approaches used by teachers Geography in teaching

ICT approaches used by teachers Geography in teaching	Total	Percentage (%)
Interactive Video	2	6.7
Technology Geospatial – Google Earth, Google Map	2	6.7
Educational Games (Kahoot, Quizizz)	8	26.7
Mobile Technologies (Smartphone/tablet)	12	40.0
Interactive white board	6	20.0
Total	30	100

4.3 Enhancing Student Interest in Challenging Geography Topics

Table 3 summarizes teachers' perspectives on enhancing student interest in geography by technology. The findings indicate that teachers employ various technological approaches to increase student engagement in the subject. Interactive videos have emerged as a powerful tool in geography education. Teachers allow students to engage with content actively rather than passively watching. By incorporating clickable elements and simulations, these videos can help students visualize complex geographical processes and phenomena to easier understandable. The immediate feedback provided by interactive elements can reinforce learning and correct misconceptions in real-time. According to Teachers 3 and 4:

“Interactive videos have completely transformed how my students interact with challenging geographical content. The clickable elements and simulations allow students to visualize complex geographical processes in a way that's much easier to understand. For example, when studying plate tectonics, students can click through different stages of the process” (Teacher 3, Age 32).

"These tools have brought a significant advancement to how we teach spatial concepts. Students can now explore and interact with spatial data in ways that were simply impossible with traditional paper maps” (Teacher 4, Age 44)

Besides, the use of geospatial technologies like Google Earth and Google Map represents a significant advancement in geography education. These tools allow students to explore and interact with spatial data in ways that were previously impossible with traditional maps. By creating custom maps and visualizing geographical data, students can develop a deeper understanding of spatial relationships and global perspectives. This hands-on approach not only makes learning more engaging but also helps students develop important spatial thinking skills that are crucial in geography. Teachers 2 and 3 explained:

"Before, when we studied climate zones, students struggled to visualize global patterns. Now, with Google Earth's climate layer, they can see these zones come to life. I've noticed a significant increase in 'aha!' moments in class" (Teacher 2, Age 37).

“I've seen a marked improvement in students' ability to think spatially. When we use Google Earth to study urban planning, they're not just looking at cities; they're analyzing spatial relationships, considering factors like proximity to resources and transportation networks" (Teacher 3, Age 32)

Games can significantly boost students' interest in geography. The integration of gamification elements in geography education taps into students' intrinsic motivation, making learning more enjoyable and competitive. Educational games and quizzes can increase student engagement and motivation, leading to improved learning outcomes. In geography, gamification can be particularly effective for memorizing place names, understanding map skills, and exploring geographical concepts in a low-stakes, enjoyable environment. For example, Teachers 2 and 5 explained:

"Since we introduced geography quiz games in our lessons, I've noticed a significant increase in student engagement. Even students who were previously uninterested are now eagerly participating, competing to answer questions about capital cities and landforms" (Teacher 5, Age 28).

"Gamification has been a game-changer for teaching map skills. Students who struggled with traditional methods are now excelling when we use interactive, game-based activities to explore cartographic concepts" (Teacher 2, Age 37).

Besides, smartphones and tablets offer opportunities for geography education. Mobile devices can extend learning beyond the classroom, allowing students to access interactive maps, virtual tours, and educational games anytime, anywhere. This accessibility can foster independent exploration and deepen understanding of geographical topics through real-world applications. Mobile technologies also enable location-based learning experiences, where students can engage with their immediate environment to understand geographical concepts. Teachers 4 and 2 said:

"Mobile technology has completely transformed our approach to field trips. Last month, we visited a nearby river system. Students used their smartphones to record GPS coordinates and take photos of geographical features. It was like having a portable geography lab in their pockets. When we returned to class, students used the data they collected for presentations using Canva or PowerPoint" (Teacher 4, Age 44).

"I found that tablets can be a powerful tool in the classroom. When I introduced educational games and quizzes accessible through tablets, I noticed a significant change in student engagement" (Teacher 5, Age 28).

Meanwhile interactive white board allow teachers to display dynamic, colorful maps, diagrams, and geographical models. This visual aspect can significantly improve students' understanding of complex geographical concepts. The visual nature of interactive white board can help capture and maintain student attention, making lessons more engaging. Interactive white boards also enable teachers and students to manipulate geographical data and images in real-time. For instance, zooming in on map features, annotating diagrams, or demonstrating geographical processes through animation. These interactive features can increase student participation and interest in the subject matter. These technological approaches collectively represent a shift towards more interactive, student-centered learning in geography education. By leveraging these tools, teachers can create more engaging and effective learning experiences that cater to

diverse learning styles and preferences. Regarding this, Respondent 2, aged 37 said:

"For group projects on natural disasters, students use the interactive white board to present their findings. They can easily switch between their slides, web resources, and interactive maps. It's fostered a more collaborative classroom environment" (Respondent 2, Age 37).

Table 4: Enhancing Student Interest in Geography Through the Use of Technology

Technology used during teaching sessions	Description
Interactive Video	Interactive videos make geography lessons more engaging by allowing students to interact with content through clickable elements and simulations, helping them visualize and understand complex concepts. This dynamic approach caters to various learning styles, enhances student interest, and provides instant feedback, making learning more enjoyable and effective.
Technology Geospatial – Google Earth, My maps	Using technology like Google Earth and Google Map enhances student interest in geography by allowing them to explore interactive maps, create customized maps, and visualize geographical data, fostering a deeper understanding of spatial relationships and global perspectives. These tools facilitate hands-on learning experiences that engage students in real-world applications of geographical concepts, making the subject more accessible and engaging.
Gamification	Implementing educational games and quizzes that incorporate geographical content to make learning fun and competitive, thus increasing student motivation and interest in the subject.
Smartphone/tablet	Smartphones and tablets enhance student interest in geography by providing access to mobile applications that offer interactive maps, virtual tours, and educational games, making learning geospatial concepts more accessible and engaging outside of the classroom. This accessibility fosters independent exploration and deepens understanding of geographical topics through interactive and real-world applications.
Interactive white board	Interactive whiteboards enhance student interest in geography by enabling dynamic visual presentations, interactive mapping exercises, and collaborative learning activities, fostering deeper engagement with geographical concepts. This technology facilitates real-time interaction, multimedia integration, and hands-on exploration of geographic data, making learning more interactive and compelling for students.

5. CONCLUSION

This study illuminates the potential of Information and Communication Technology (ICT) in addressing challenging topics in geography for lower secondary students. The research reveals critical areas of difficulty in geography education, including topography maps, drainage systems, and landforms, underscoring the need for innovative teaching approaches to make challenging topics more accessible and understandable for students. The widespread adoption of mobile technologies and educational games by teachers signifies a shift towards more interactive and engaging pedagogical methods, aligning with contemporary educational theories that emphasize active learning. The positive impact of ICT on student interest and understanding is particularly significant. Interactive videos, geospatial technologies, and

gamification demonstrate effectiveness in visualizing complex geographical concepts and processes. This discovery reinforces the role of technology in transforming geography from a subject that some students consider difficult to understand into an interactive, engaging exploration of the world. The results of this research have broader implications for curriculum design, teacher training, and educational policy. These insights pave the way for reimagining geography education by harnessing the power of technology to cultivate spatial thinking skills, geographical knowledge, and a deeper understanding of our interconnected world. It beckons educators and policymakers to embrace innovative approaches that can make geography more accessible, engaging, and relevant to the lives of young learners.

The integration of Information and Communication Technology (ICT) in geography education has shown promising results, yet there remain numerous avenues for further exploration. This study has identified several key areas that warrant additional research to enhance our understanding and implementation of ICT in geography classrooms. One primary area for future research lies in the quantitative assessment of learning outcomes. While qualitative studies have provided valuable insights, there is a pressing need for rigorous quantitative evaluations to measure the tangible impact of ICT integration on student performance in geography. Such studies could involve comparative analyses of different ICT tools across various geographical topics, helping to identify the most effective technologies for specific learning objectives. This approach would provide empirical evidence to guide educators and policymakers in making informed decisions about ICT implementation.

Another crucial aspect that requires further investigation is the student perspective on ICT use in geography education. Gathering comprehensive feedback from learners about various ICT tools would offer invaluable insights into which technologies are most effective from the users' point of view. This user-centered approach could inform more targeted and effective implementation strategies, ensuring that the technologies employed are not only pedagogically sound but also engaging and accessible to students. The role of teachers in successful ICT integration cannot be overstated, and as such, research into the relationship between teachers' ICT proficiency and the effectiveness of technology integration is vital. Such studies could inform the design of targeted professional development programs, leading to more efficient and impactful teacher training initiatives. By understanding how teachers' technological skills and confidence influence the success of ICT implementation, we can better prepare educators to leverage these tools effectively in their classrooms.

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