Journal of ICT in Education (JICTIE)
ISSN 2289-7844 / 10 / 1 / 2023 / 26-39

Systematic Literature Review on Digital Courseware Usage in Geography Subjects for Secondary School Students

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To cite this article (APA): Ghafar,N.A., Rahmatullah, B., Razak, N.A, Muttalib, F.H.A., Adnan, M.H.M & Sarah, L.L. (2023). Systematic literature review on digital courseware usage in geography subjects for secondary school students. *Journal of ICT in Education*, *10*(1), 26-39. https://doi.org/10.37134/jictie.vol10.1.3.2023

To link to this article: https://doi.org/10.37134/jictie. vol10.1.3.2023

Abstract

Rapid technological advances are having an impact on the field of education. Multimedia courseware is a widely used option to help facilitate teaching and learning in the classroom. A large selection of courseware that covers many learning topics makes it easier for teachers to use it. The use of courseware that includes multimedia elements such as text, images, audio, and video, to some extent, can attract students and help their understanding process, in addition to its easy access on various platforms. However, little comprehensive analysis of digital courseware usage, especially in geography subjects for secondary school students. To the best of the authors' knowledge, no comprehensive analysis understands the use of digital courseware among students in geography subjects. Therefore, this systematic literature review aims to examine the use of courseware in the teaching and learning process of Geography subjects for secondary school students. The search strategy was made to gather articles in the Scopus databases from 2013 to 2021, and 257 articles have been found. Based on the inclusion and exclusion criteria, 13 articles were selected for the review. The findings of this systematic and comprehensive evaluation of the literature indicate that courseware can enhance learners' comprehension and encourage them to study Geography among students. The findings offer significant implications for digital courseware usage and geography subject communities, especially for policymakers, teachers, and developers to strategize and reflect on the practice they implemented and improvised if necessary for future sustainable education and efficient teachers' performance in teaching.

Keywords: digital courseware, geography, secondary school, thematic analysis, systematic literature review.

Received: 31 August 2021; Accepted: 9 February 2022; Published: 24 February 2022

INTRODUCTION

One-way communication between the teacher or instructor and the students is the hallmark of traditional education, which is still practiced in many classrooms today. This approach lacks a modification to promote classroom collaboration as teaching and learning should be dynamic. Due to this modern teaching method, some of them might not need to attend the class. Education experts have recently advocated switching from the traditional teaching method to one that encourages classroom interaction as the most meaningful (Pantuwong et al., 2016, Roslin et al., 2022).

Recently, there have been a large number of researchers focusing on the development of new teaching tools to improve learning outcomes for some courses (Mohamad et al., 2022, Hasbullah et al., 2022). Various types of software and tools are freely available for use by teachers in schools. Students in Malaysian public secondary schools are required to take geography as one of their core subjects. Geographical knowledge, physical geography, human geography, and regional geography, as well as themes connected to current events and field studies, are the themes covered in the subject. Previously, the field of geography did not have a very broad application as it only covered a small range of topics (Harichandan et al., 2013). Teaching geography in schools does not just focus on theory; it also needs independent practice on a variety of subjects by the students. Students benefit greatly from the usage of tools since it makes it easy to understand the concepts. Students who receive only theoretical instruction will likewise become disinterested quickly and believe that geography is a dull and uninteresting subject (Harichandan et al., 2013).

Some geography teachers have chosen to stay static, which is detrimental to the advancement of geography education, due to the information hurdles brought about by the quick development of technology and the digital divide caused by big data in geography. Studying and exploring the "user manual" of geoinformation technology that is appropriate for secondary school geography teachers of various ages is another significant problem that has to be resolved in the area of geography education (Li et al., 2022). However, little comprehensive analysis of digital courseware usage, especially in geography subjects for secondary school students. To the best of the authors' knowledge, no comprehensive analysis understands the use of digital courseware among students in geography subjects. Therefore, a systematic literature review (SLR) was conducted to examine the use of courseware in the teaching and learning process of Geography subjects for secondary school students. This SLR would investigate the learning process in geography subjects related to digital courseware that is used to attract students to learn geography and to help students remember facts related to a topic. The research question is how extent to which the use of courseware affects students in geography learning.

To address the research question, the paper is organized as follows: The first section presents the description of related works on the geography learning-related process. The procedure for gathering information and examining it for this set of studies is then explained, followed by the findings, limitations, future work recommendations, and conclusion.

LITERATURE REVIEW

In the last ten years, education has enabled the development of students' cognitive and psychomotor skills via the integration of Information and Communication Technology (ICT) into the teaching and learning process. For example, the use of multimedia, allows students to gradually form and develop their skills in the area of sensory perception (Magdin & Solcova, 2016, Sudin et al., 2022).

Software like Geographic Information Systems (GIS), Google Earth (GE), GeoLO+, and Maps4Learning are used in several courses to teach about maps and people. Tools can be used for various learning techniques such as project-based learning, inquiry-based learning, and problem-based learning. Empirical studies suggest that the use of such courseware in Malaysian classrooms is particularly uncommon, and the utilization of such tools by teachers in the classroom is quite restricted (Razak et al., 2021; Subban et al., 2022).

Major challenges to implementing GIS in schools include a lack of administrative support, a lack of GIS knowledge and expertise on the part of the teachers, and the requirement for GIS in the curriculum (Demirci, Karaburun, & Ünlü, 2013). However, using the proper tools would overcome the challenges that benefit teachers' instruction, have a positive effect on students' comprehension, and encourage students to pursue geography as a field of study. Students will also think geography is a simple and enjoyable subject. The use of tools or courseware in geography classes has been found to increase student interest in the subject and improve their understanding. It can also assist teachers in clearly presenting a subject using actual instances and circumstances (Akhmalludin & Ayu, 2019).

METHODS

To conduct this SLR, articles are searched through the Scopus database using the keyword "digital" OR "courseware" OR "tools" OR "software" OR "online system" OR "online tools" OR "online application" OR "digital application" AND "geography" AND "learn*" OR "education" OR "teach*" AND "high school" OR "middle school" OR "secondary school". Based on these keywords, a total of 257 articles have been identified.

Study selection was conducted accordingly to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), as shown in Figure 1. The articles were filtered twice according to the sequence adopted in this research. On the first screening, 221 records were excluded from the abstract because they were not related to the study. This made the remaining full-text article eligible for the next screening is 36 papers. The full-text article was then filtered, and eight (8) papers were excluded because they were not written in English, and 15 papers were not related to the study. 13 papers remained as the final articles to be reviewed. The inclusion criteria that should be met in the systemic search are English languages written, availability of full-text, and 2018 to 2021 published paper.

Received: 31 August 2021; Accepted: 9 February 2022; Published: 24 February 2022

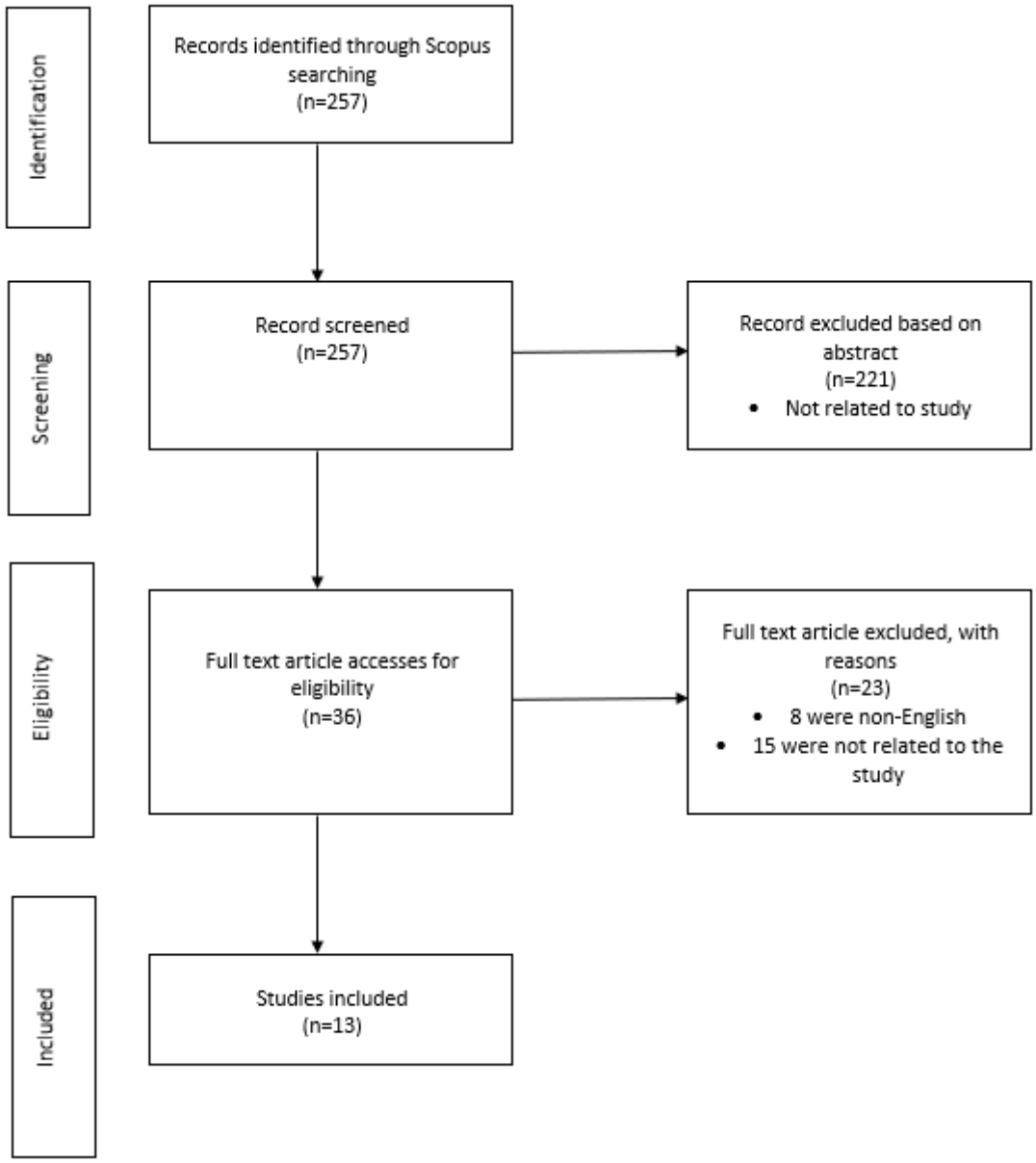

Figure 1: Articles selection Flowchart

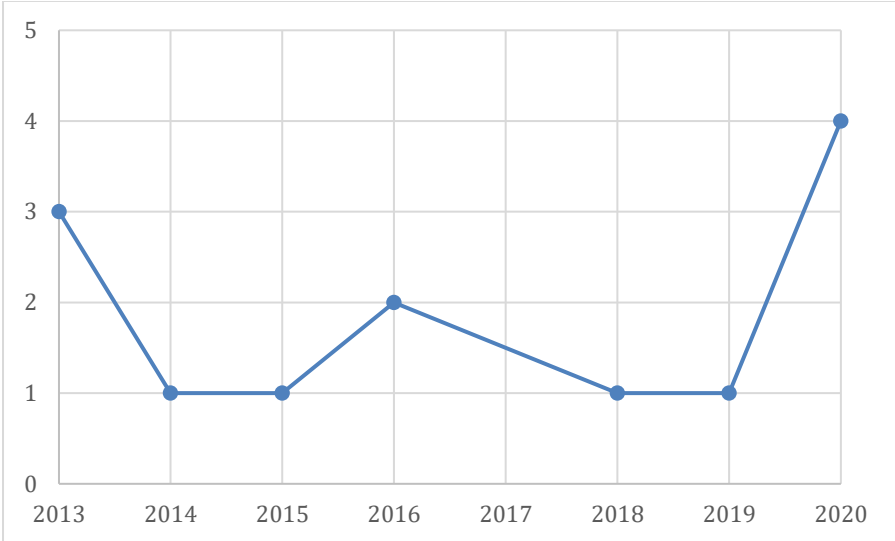

Figure 2: Distribution of publications from 2013 to 2020

As shown in Figure 2, the articles were published within 8 years, from 2013 to 2020. 4 articles were published in 2020, 3 in 2013, 2 articles in 2016, and one each in 2014, 2015, 2018, and 2019.

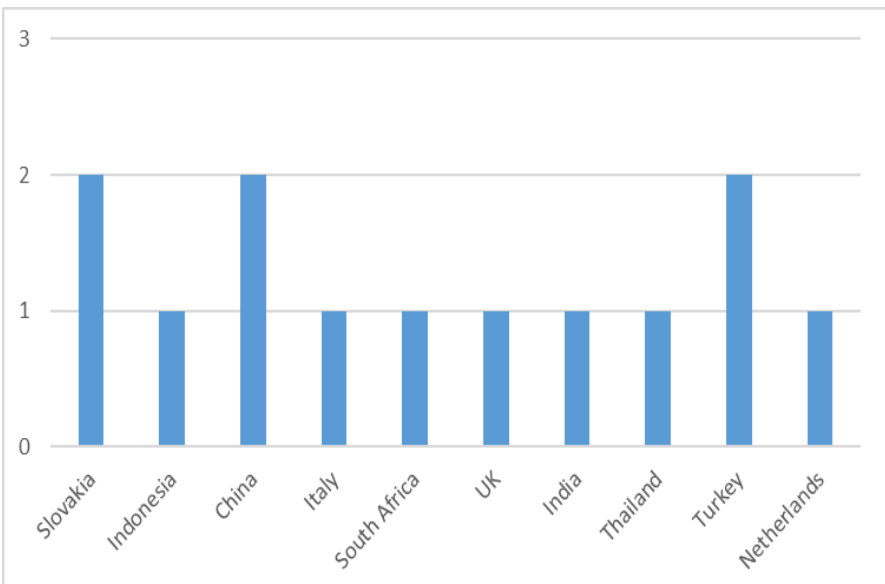

Figure 3: Distributions by authors' nationality

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Figure 3 shows the selected articles written by authors from 10 countries. The geographical distribution authors were 2 articles each from Slovakia, China, and Turkey, followed by Indonesia, Italy, South Africa, the UK, India, Thailand, and the Netherlands with one article each.

RESULTS

The distribution of the research methods in the selected articles has been identified and shown in Figure 4. The first is the qualitative method which is the most often used method in six articles. The quantitative method is the second most used method, with 5 articles that applied it in the studies. The mixed method was the least used method, with only two articles that used it.

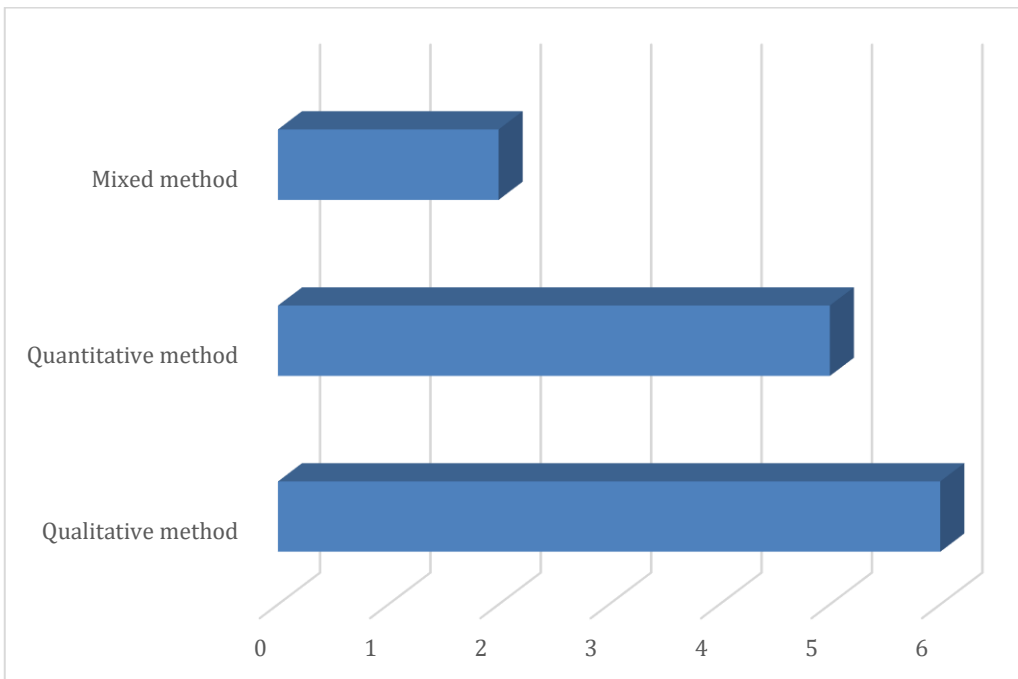

Figure 4: Distributions by the method used in articles

Demographics of selected studies shown in Table 1 below.

Table 1: Demographics of selected studies

Author	Country	Methods Used	Tools	Participants	Theme
(Demirci, Karaburun, & Ünlü, 2013)	Turkey	Quantitative method	Geographic Information Systems (GIS)	383 secondary school students	Effectiveness, Learning Activities
(Demirci, Karaburun, & Kilar, 2013)	Turkey	Quantitative method	Google Earth (GE)	75 secondary school students	Effectiveness
(Kerawalla et al., 2013)	UK	Qualitative method	nQuire	Secondary school students	Learning Activities
(Favier & van der Schee, 2014)	Netherlands	Mixed methods	Geospatial Technologies	247 secondary school students	Effectiveness
(Magdin & Solcova, 2016)	Slovakia	Quantitative method	Interactive Textbooks	97 secondary school students	Effectiveness, Content of Learning, Learning Activities
(Pantuwong et al., 2016)	Thailand	Qualitative method	Augmented Reality (AR) Sandbox	11 secondary school students	Learning Activities
(Sarkar et al., 2016)	India	Quantitative method	America India Foundation's Digital Equalizer (DE)	832 secondary school students	Content of Learning, Learning Activities
(Wu et al., 2018)	China	Qualitative method	ArcGIS	Secondary school students	Content of Learning, Learning Activities
(Akhmalludin & Ayu, 2019)	Indonesia	Qualitative method	Augmented Reality (AR)	40 secondary school students	Effectiveness
(Xiao et al., 2020)	China	Quantitative method	Augmented Reality (AR)	36 secondary school students	Effectiveness, Content of Learning, Learning Activities
(Sebillo et al., 2020)	Italy	Mixed method	GeoLO+, Maps4Learning	179 secondary school students (92 girls and 87 boys)	Learning Activities
(Mkhongi & Musakwa, 2020)	South Africa	Quantitative method	Geographic Information Systems (GIS)	Secondary school students	Effectiveness
(Csachová, 2020)	Slovakia	Qualitative method	Geographic Information Systems (GIS)	662 secondary school students	Content of Learning, Learning Activities

*Secondary school student age ranges from 11 to 17 years old.

Thematic Analysis

A technique for assessing qualitative data is a thematic analysis by Braun and Clarke (2006). The researchers analyzed carefully the data to find common elements, concepts, and structures of significance that emerged. The procedure of doing the thematic analysis was approached in the following method that involves six steps: familiarization, code, producing themes, ideas discussed,

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describing and labeling themes, and summarizing. We found three most commonly recurring themes from the papers, namely: Effectiveness, Content of Learning, and Learning Activities.

Effectiveness

Effectiveness is determined by assessing the degree to which courseware successfully aids students in learning geography or whether it was successful in the study. According to Xiao et al. (2020), students who took part in the learning for the course studied in their research expressed interest in taking it again and encouraged others to take part in the augmented reality learning process. The students believed it increased their understanding of the "eight planets." This shows that the event's content design is beneficial to students and can foster the development of student's knowledge.

In a study by Demirci, Karaburun, and Ünlü (2013), the GIS-based project gave the students a better understanding of what GIS is and how it was used. According to their survey, 95% of students felt that the project improved their understanding of the fundamentals of GIS and why it is employed.

The performance, drive, and excitement of students throughout training and their perceptions of Google Earth (GE) during training suggest that GE is useful for geography teaching. GE acted as a platform for students to discuss, interact with, and make comments in dynamic environments. A Digital Earth map is a tool for visualizing what is taught in the classroom. One of the studies found the most crucial finding was that the majority of students enjoyed the activity because they thought it was fascinating and beneficial (Demirci, Karaburun, & Kilar, 2013).

Akhmalludin and Ayu (2019) discovered that the students in the augmented reality (AR) group outperformed the students in the non-AR group based on a comparison of the participant's improved scores within the two groups. According to Favier and Van-der-schee (2014), students who participated in a series of lessons on water-related spatial planning issues using Watermanager and EduGIS performed better on tests of relationship thinking and were more optimistic about the effects on learning outcomes than students who participated in a similar series of traditional lessons using schoolbooks. Favier and Van-der-schee's study concluded that geography education using geospatial technology has a positive impact on students' thinking ability.

According to Mkhongi and Musakwa (2020), GIS education has significant promise as a conduit for the notion of increased geographic performance and spatial thinking. GIS education has become widely accepted, particularly in geography, as an approach that could enable creative methods of imparting knowledge about and understanding spatial concepts.

As reported by Magdin and Solcova (2016) in their quantitative study, most of the students agreed that an interactive textbook able to enhance geography learning is sufficiently demonstrated in researchers' studies as long as the particular chapters are adequately interactive and graphical. Students believe that through reading the textbook, they were better able to comprehend the course material.

Content of Learning

Students could more quickly and thoroughly understand the information displayed on the map with the use of an ArcGIS or thematic map. ArcMap in ArcGIS, for instance, may concurrently display the absolute population of each administrative region in China, allowing students to compare the populations of the various provinces and gain a better understanding of the data presented (Wu et al., 2018). A study by Csachová (2020) revealed that students gather, arrange, and evaluate data on the world's demographic and political map using a Web GIS platform.

The course "Eight Planets in the Solar System" was used by Xiao et al. (2020) to conduct experimental learning design and experimental research. Xiao et al. (2020) introduces fundamental knowledge of the eight planets in the solar system, such as knowing the fundamental structure of the eight planets, describing the planets' positions and movements, and mastering their characteristics and the proper arrangement around the sun.

Magdin and Solcova (2016) experimented with the interactive geography practice book for high school students that is divided into three (3) sections: 1) Introduction to geography, 2) physical geography, and 3) human geography. Magdin and Solcova (2016) focused more on physical geography, which is broken up into chapters and georelief lithosphere, atmosphere, hydrosphere, pedosphere, biosphere, nature, and landscape protection.

Sarkar et al. (2016) observed a remarkable improvement in the Geography score in their study. Sarkar et al. (2016) explained the improvement was because concepts like seasonal change, rotation, revolution, latitude, and longitude, deal with many abstractions and are difficult for children to understand without the use of visual aids. The students in their treatment schools were able to grasp the fundamentals, which translated itself into a dramatic improvement in learning outcomes. These learning outcomes were made possible by the use of these visual aids, such as animations, videos, and other materials, woven around technology-integrated lesson plans and specially created activities.

Learning Activities

Wu et al. (2018) explain how they used ArcGIS to assist secondary school students in enhancing their spatial information literacy and innovative thinking abilities. On the one hand, this could result in more material, but on the other, geography instruction would become more natural, colorful, and adaptive. Through the use of this program, the possibility of high-quality national education is offered, one in which colorful graphics and descriptions rather than dry text will serve to teach geography. Data analysis that is visually presented replaced laborious data interpretation and challenging chalkboard procedures, making the learning environment more pleasurable for both teachers and students.

To construct courseware content design, Xiao et al. (2020) study focused on four (4) stages of experiential learning courseware for each planet. First, graphic introduction and watching of micro-

videos during the emotional stage. Second, in the observation stage, exercises like scene simulations using augmented reality technology were used. Three, in the thinking stage, mind maps were used and at the practical stage, Last, questions and games were used to test new theories and concepts.

In the Demirci, Karaburun, and Ünlü (2013) study, project-based learning (PBL) with Geographic Information Systems (GIS) was the main focus. Students conducted interviews with locals in their school districts to comprehend the significant social, environmental, and economic challenges in the area and then used GIS to address issues that were discovered.

In the geography practice book, Magdin and Solcova (2016) provide various distinct assignments. Topics and tasks are illustrated using pictures, maps, tables, and graphs. Topics are introduced using engaging written and audio content. A stimulating and interactive processing curriculum increased student engagement, creativity, and motivation. The book impressed younger children who were interested in geography as well as secondary school students. The study by Magdin and Solcova (2016) also offered a few assignment examples. Open-ended questions, picture, and graphic assignments, right and wrong claims, adding text, designing the proper pair, choosing the right response, and other forms of assignments are among the many various types available.

When it comes to developing practical and hands-on skills, traditional maps cannot match ArcGIS' robust data collecting, management, analysis, and presentation functions, which allow students to interpret diagrams, plots, and analyses. Data analysis that is visually presented can also demonstrate how it can replace time-consuming data interpretation and challenging chalkboard procedures, making the learning experience more pleasurable for both teachers and students. According to Csachová (2020), students can obtain geographic sources, gather data, and conduct data analysis with the help of the Web GIS platform. Students loved the activity, and they were inspired to complete assignments that required the use of atlases and Web GIS tools, as well as having time for discussion. Teachers are also able to spot errors in student work. The practice led to fruitful debates among the students about topics like whether or not a state might occupy multiple morphological categories. The practice supports students' "choices in learning," such as whether they want to collaborate with Singapore or Gibraltar.

According to Kerawalla et al. (2013), nQuire courseware provided the students with a representation of the entire inquiry process and provided guideposts to aid in their progress. For example, teachers and researchers together created nQuire to provide students with a set of tasks to accomplish as well as to force them to make crucial methodological choices by giving them options for equipment and the chance to write their hypotheses. The student's hypothesis in this case represented their current opinions on their school grounds based on their prior personal experiences with them, which they could then empirically evaluate. Therefore, nQuire was successful in offering the students the chance to customize their inquiry and carefully consider what they wanted to research, why they wanted to investigate it, and how they do the investigation. Students were able to participate in the design and implementation of the inquiry process in nQuire, making it more than just a set of guidelines or a

formula. The groups were forming their emerging notion of "conducting an inquiry" within and through this adaptable, developing, cooperatively produced inquiry environment.

Pantuwong et al. (2016) employed AR technology in their study to allow users to see changes to the terrain in real-time and the ability to experience real-time terrain alteration. The system will sense the change in sand height and project the appropriate color and contour line by the height at each point. The outcomes of the pilot study might attest to the effectiveness of the suggested system.

The first phase of the Sebillo et al. (2020) study was carried out in the usability engineering lab of the University of Salerno's Department of Computer Science. The teams in their study had two hours to come up with subjects to include in the geoLO+ resource and develop a set of questions that may be used for learning evaluation exams. An observer sat behind each team during the construction session and noted any mistakes, how long it took to accomplish each task, and any remarks made by the participants, who were invited to think aloud while working together on the tasks. During routine classroom activities, the second portion of the experiment examined how well students were learning and how they responded to the inclusion of geoLO+ in the Maps4Learning platform.

The study by Sarkar et al. (2016) showed the importance of teacher preparation. The regular coaching and mentoring provided at the school level by Digital Equalizer (DE) resource people, together with the five (5) days of teacher training based on technology pedagogy, helped pupils understand the curriculum subjects. The curriculum of the school is closely incorporated into the program, enhancing subject matter knowledge by utilizing technology. Through a series of PBL activities that assist students in making connections between their academic studies and real-world circumstances, the DE approach focuses on providing a framework for fostering children's capacity for critical thought, teamwork, and effective communication. An inquiry-based teaching and learning method focused on "exploratory play" is known as PBL. Projects are frequently used to study concepts, sub-concepts, and "hard spots" (concepts that are challenging to explain) from a teacher's perspective. The teachers at School Point receive constant coaching and mentoring from America India Foundation (AIF) resource individuals who assist them in developing an efficient instructional design and in thoughtfully considering and planning out their lesson plans.

LIMITATIONS

According to Wu et al. (2018), geographic information processed by ArcGIS software expressed in raster and vector data format is very helpful in high school geography teaching. The majority of the processed data is vector data, which refers to data in specific (x, y) coordinates and has accurate geographic data. However, it costs a lot of money to purchase it. Modern, professional geographic information mapping software has seen low acceptance rates in classroom geography education since schools in rural areas cannot afford to subscribe to it.

The use of AR in education is still in its early stages and has a tiny sample size. It is also a short-term

application. Additionally, it encountered issues with the study design, so it increased the sample size and created a more comprehensive research design (Xiao et al., 2020).

The old curriculum's shortcomings, such as the few geography sessions per week, teachers with less advanced digital abilities, and a lack of adequate digital technology equipment in schools, were discovered throughout the trial phase of Csachová (2020) study. However, they claimed that such lessons enrich and enliven the teaching and learning process and involve students more directly in their work based on teachers' subjective perceptions.

FUTURE WORKS AND RECOMMENDATIONS

When creating any interactive approaches, Xiao et al. (2020) recommended that diversification and avoiding the use of just one interactive technique should be taken into account. When giving lectures, instructors should pay special attention to the direction of their student's learning activities and assist them to achieve an effective immersive learning experience.

Sebillo et al. (2020) suggested that this new system of learning should be made accessible on mobile devices. They further suggest that the proposed system's mobile application can assist users in considering learning in ways that complement and possibly disapprove of formal education, i.e., learning that can happen whenever and wherever it sees fit, is personalized, situated, and authentic, and that is linked to the regular use of mobile devices.

Additionally, Akhmalludin and Ayu (2019) recommended that learning is about tools that might be used to create marker-less AR Currently, only a few smartphone editions are supported by such technology (e.g., Vuforia), making it inaccessible for all smartphone models. As technology advances throughout time, there is a larger chance of overcoming this constraint in the future. Perhaps, future research can incorporate all of the advantages and possibilities that AR technology has to offer.

CONCLUSION

In this paper, the efficacy of teaching resources for geography in secondary schools was systematically reviewed. As information technology has advanced, several tools and courseware are now easily accessible and may be used with a variety of themes. The methodology used in the data collection and analysis for this systematic literature review is then described, along with the results. The PRISMA filtering method was used to remove the articles. The majority of the published study comes from Asia and was done within the setting of higher education. Therefore, future research on digital courseware in secondary schools is needed. Based on the results, a variety of techniques, including geospatial technologies, GE, AR, and GIS, have been employed to ensure effective geography learning. Tools and course materials in this situation may encourage students to study geography and deepen their understanding by incorporating those resources into the learning experience.

According to the papers that have been evaluated, teachers have started to utilize courseware in their classrooms. Other than geography, it can be used in other disciplines, including science, arithmetic, history, and even languages. Other tools are used as well, including AR, GIS, and interactive textbooks. One of the author's personal experiences as a Geography subject teacher in a Malaysian school has shown that there are limitations to the usage of courseware in Malaysian classrooms. The first issue is faulty pieces of equipment, which usually prevents the teacher from connecting to a Liquid Crystal Display (LCD) or computer. The shortage of ICT equipment, including computers, LCDs, and other devices that are ready for use, comes next. Some teachers decide to take the initiative themselves and purchase their LCDs to use in the classroom as a result of this issue. However, the learning period will be brief due to the lengthy installation process for this product. Additionally, due to the school's subpar internet connection, teachers have difficulty utilizing classroom technology. These represent some of the difficulties that would have to be addressed for the courseware-based teaching and learning process to be successfully applied in the classroom.

In conclusion, the findings offer significant implications for digital courseware usage and geography subject communities, especially for policymakers, teachers, and developers to strategize and reflect on the practice they implemented and improvised if necessary for future sustainable education and efficient teachers' performance in teaching.

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