Exploring the Real Impact of ICT Tools on Secondary School Students' Learning of Geography

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This study investigates the impact of ICT tools on student motivation, specifically examining whether immersive experiences, such as using Google Earth, enhance the understanding of geographical concepts in secondary school geography classes. A mixed-methods survey was conducted with 100 students participating in specific geographical educational activities. The data analysis revealed that using Google Earth significantly influences student motivation. The study found that virtual field trips enhance and increase students' enthusiasm for learning geography. An open-ended questionnaire was administered to 100 students out of a total of 450, revealing a statistically significant improvement in learning outcomes when students engaged in virtual field trips using experimental and self-directed learning strategies. The findings support the importance of experiential and self-directed learning strategies in teaching geography through virtual field trips. Moreover, the integration of ICT tools facilitates a deeper understanding of geographical concepts while fostering a more collaborative, interactive, and immersive learning environment. The study also indicates that student motivation was unaffected by previous ICT tool experience or gender. In light of these findings the study recommends incorporating digital and professional competencies in teacher training to prepare them for designing smart, flexible classrooms that cater to learners' needs in the digital age.

Keywords: Professional competencies, middle school students, teaching geography, experiential and self-directed learning strategies, ICT tools.

Introduction

The use of information and communication technologies (ICTs) in the geography classroom has grown significantly over time (Somekh, 2007). However, a number of considerations must be made while analyzing the impact of ICT technologies on high school learners' geography education. These include the specific types of ICT tools utilized, the degree of student involvement, the efficacy of the tools in improving comprehension of geographical concepts, and the overall education outcomes attained (Bikar et al., 2022). This research aimed to explore these considerations to gain insights into the potential impact of ICT tools on students' geography education experiences. Learning based on ICT tools can improve students' digital literacy, their ability to think critically, and their ability to be more effective and efficient in digital learning environments (Burden et al., 2019). The use of ICT can also facilitate more interaction and engagement with learning (Beetham & Sharpe, 2007). An example of the latter is the use of the Google Expedition App and Google Maps by geography students (Toma et al., 2023). Covid19 highlighted the need to provide education via ICT tools remotely (Toma et al., 2023), however, it is through the development of student interest and enthusiasm that these benefits can be fully realized (Anderson, 2016). The focus should be on the pedagogy informing how technology is used and how it affects students' learning, not simply on the appeal of emerging technology developments themselves (Glover et al., 2016). Boggs (2019) highlights that technology has changed how we learn, think, live, and work. Many studies indicate that ICT plays a significant role in learning and teaching. For example, Esfijani et al. (2020, p. 1) highlight that "in educational settings, the integration of ICT is becoming a significant concern and has gained the governments' support and attention in both developed and developing countries." Therefore, when learning technology is integrated into the curriculum, it should improve the depth and breadth of the curriculum appropriately (Razak et al., 2018). However, Beetham & Sharpe (2007) emphasise that the use of technology in teaching and learning requires rethinking pedagogical strategies to be effective.

ICT facilitates both educators and students to function more efficiently (Lawrence & Tar, 2018; Aslan & Zhu, 2017). Investigative analyses such as those conducted by Baş and Baştuğ (2020) have clearly demonstrated that ICT use in education offers promising results towards student development, teaching-learning cooperation, and constructivist speculation. However, although ICT impacts almost every dimension of students' daily lives

equating our students with having natural ICT competency or being “digital natives," is a mistake. Recent studies have shown that such presupposed notions have proven to be quite misleading (Schmid & Petko 2019). Learners do not automatically make the link between the social use of technology and the educational affordances (Beetham & White, 2014).

As more and more students cultivate technological competence (Schmid & Petko, 2019) there is a widening gap between the everyday experiences of students and learning in the classroom (Bas & Bastug, 2020). There is a need to research how to change the way we teach and learn geography in secondary schools by using ICT tools that are authentic to this context. Rambousek et al. (2014) argue that ICT tools enhance learners’ skills and abilities to think critically and to solve problems in their learning. Hence, this research aims to investigate how the incorporation of ICT can enhance motivation in geography learning. Specifically, the study aims to explore the tangible effects of utilizing specific digital technologies, such as Google Maps and Google Earth, as ICT tools in the learning process of geography.

Literature review

ICT tools in geography education

The aim of modern geography is to understand the spatial distribution of spatial phenomena and the spatial interactions between the environment and humanity. It examines, for example, the distribution of health services, urban planning, industry, economics, and climate change in a certain area. Geography is extremely active today (Author1, 2020). Author1’s research findings verify that for example, in the UK, the USA, and Australia, there is a surprising gap in the usage of ICT in geography education. Building upon the Technological Pedagogical Content Knowledge (TPACK) framework (Voogt et al., 2012), Author1 argues that Geographical Pedagogical Content Knowledge (GPCK) can be developed by using ICT in geography education. Modern geography education is enriched with a wide range of ICT tools that expand upon the extraordinary visual capabilities of modern computers. Google Earth is one example of this kind of tool (Garyfallidou & Ioannidis, 2014). The study's findings by Garyfallidou and Ioannidis (2014) confirm that the experiment shows that students may learn geography and improve their ICT abilities in the classroom by using computers in a positive way. Additionally, there was a noticeable improvement in the students' ability to collaborate and communicate with each other. When students utilized ICT to save, present, analyze, and manipulate space-related data, they increased their motivation to learn geography as well as their engagement and achievement (Singh et al., 2013; Yazici & Dermikaya, 2010; Vos et al., 2011). Additionally, it is noted that integrating ICT into the design of lessons is crucial to the effectiveness of teachers' use of technology. The previously mentioned example demonstrates that without the input and planning of teachers, ICT alone will not significantly change learning outcomes (Dambudzo, 2014; Tezci, 2009). There are a very small number of studies that have reviewed the use of ICT for learning and teaching in geography (Author 1, 2020); Therefore, more research should be done on effectively integrating ICT in geography education.

The use of geospatial technology, such as Geographic Information System (GIS), Global Positioning Systems (GPS), Remote Sensing (RS), and other spatial data technologies, has totally transformed geography practices. Geographically-focused technology have the potential to dramatically enhance instruction in geography by enhancing spatial thinking, involvement, and practical abilities (Edmonds & Smith, 2017). By allowing students to collaborate on projects, engage with real-world data, and depict difficult ideas, these tools enhance the relevance and dynamism of geography education. Geospatial technologies can be included in the curriculum to give students useful skills and knowledge that they can use in their daily lives and many other professions.

Benefits of ICT in the learning of geography

Numerous advantages that improve teaching and learning are provided by integrating ICT into geography education. First, interactive maps and Geographic Information Systems (GIS) are two examples of ICT applications that help students comprehend complex geographic data in an interesting and understandable way. This makes it easier to comprehend geographical patterns and spatial relationships. Second, 3D Models and Simulations: These resources can provide tangible, understandable examples of abstract ideas in physical geography, such as weather patterns, tectonic processes, and landforms (Chang & Wu, 2018; Garyfallidou & Ioannidis, 2014). ICT products frequently have interactive components that enhance learning for pupils, such as games, quizzes, and virtual field excursions (Edmonds & Smith, 2017). Students' attention and motivation can be

sustained by using audio, video, and animation resources to make geographical concepts come to life (Dambudzo, 2014). ICT allows educators to customize lessons to each student's needs. Based on student success, adaptive learning platforms modify the material and degree of difficulty, resulting in individualized learning paths. Learning is flexible, allowing students to go more quickly through subjects they already grasp and revisit difficult subjects at their own pace (Hassall, 2016). Students can also work together on projects wherever they are using Google Earth, Google Maps, and communicating via online forums. Through the assisted communication and optimized interaction within the classrooms and beyond the classroom via discussion boards, the students are able to learn with the assistance of their peers (Felix, 2012; Alan, 2017). Felix (2012) illustrates that ICT facilitates effective learning in geography as it presents affordances for presenting dynamic and interpretive learning activities with each learner. The integration of ICT in learning facilitates the development of learner digital literacies (Beetham et al., 2017) and as Favier and Van der Schee (2014) show in their study, using geospatial technologies to teach the geography to the students will enhance the student's spatial thinking skills as well as how they relate with others.

ICT and Motivation in learning geography

The influence of ICT tools on pupil learning outcomes has been a much-discussed topic. Certainly, not everybody agrees with its now presumed power to enhance, modify, and refine teaching and learning methods (Hinostroza & Matamala 2011; Selwyn 2013). Numerous writers have studied the impact of ICT tools on learners' motivation and achievement in the classroom (e.g., Shah, 2013; De Witte & Rogge, 2014; Misul and Pokorny, 2015; Umar & Yusoff, 2014; Klimova, 2015). Hwang & Chen (2016) revealed that ICT incorporation increased students' motivation (Passey & Goodison, 2004). The study by Harris & Kington (2002) also found that using ICTs in secondary schools helps to improve students' confidence and motivation.

The variable that is, arguably, the most influential when it comes to determining how big of an impact ICT will have on learning outcomes is the role of teachers (Voogt et al., 2012); they are the ones applying the new tools. Technology does not represent educational value on its own. It becomes significant when teachers purposefully integrate ICT into learning environments. This is why teachers need to understand how to use ICT resources within their pedagogical toolkit. If carried out correctly, such changes will lead to responsive, supportive, and nurturing pedagogical strategies (Zain & Idrus, 2004). For example, Sampaio & Almeida (2016) argue that ICT enables the personalization of the learning experience. The integration of ICT in classrooms gives students the chance to learn more efficiently, collaborate with one another, and fully investigate the world and society (Tuzun et al., 2008).

A search of the literature indicates that there is a gap in empirical studies on ICT use in learning geography effectively and the effect of ICT tools on students' motivation in geography education (Tuzun et al., 2008). Smith (2002) points out that the purpose of using ICT tools in secondary teaching geography is to enhance pupils' skills, gain information and geographical knowledge, deepen their understanding of spatial relationships and environments, differences between people and places, and the effect of IT on humans' environments. According to Rambousek et al. (2014), ICT can help and enhance students' skills and abilities to think critically and then to solve problems in their education.

ICT and Achievement in Geography Education

When simply used as a substitution for existing pedagogical practice (Puentedura, 2006), the literature highlights the issue of "no significant difference" in learning outcomes between traditional modes of teaching and ICT-enhanced teaching, for example (Reeves, 2005). However, Tuzun et al. (2009) state that ICT integration increased students' achievements and motivation (Hwang & Chen, 2016). To enhance learning it is necessary to change pedagogical strategies by using and developing technology (Klimova, 2015). Digital technology in learning includes many forms, such as computer programs, mobile phones, online learning, whiteboards, virtual learning, and information technology (IT). All these kinds of technology devices can support and enhance learning and teaching in all subjects in primary and secondary schools around the world. For example, Saka (2023) reported that students who received their instruction via an online tool achieved more or had higher average scores than those who received their instruction via a traditional teaching approach. The experimental group outperformed the control group in terms of results (Saka, 2023). This study also showed that there is no significant difference in academic achievement between male and female students while using internet-based teaching resources. Moreover, gender did not influence the result.

The study by Shen et al. (2022) evaluates how emotional arousal affects learning using a virtual reality geography immersion film. The study's findings demonstrate that VR video learning resources can effectively elicit both positive and negative emotions in participants. The study's main conclusion was that using an Augmented Reality Instructional Tool (ARIT) improves student performance and retention while also promoting gender equality. The study found that using ARIT can improve geography instruction and student learning (Adedokun-Shittu et al., 2020).

Geographic Information System (GIS) is a combination of computer hardware and software that stores, analyses, and visualises geographic data. GIS is used to create, manage, and analyse location-based information. GIS is an excellent tool in educational contexts, particularly for developing advanced cognitive abilities. More specifically, GIS-based teaching improves high-order cognitive abilities related to application and analysis (Yang & Qian, 2024). For example, GIS provides the information needed to make decisions and solve problems such as the impact of climate change (Smith, 2002). The advent of GPS technologies and geolocation tools such as Google Earth has transformed geography into a highly ICT-based context. Consequently, ICT tools for learning geography can be extremely advantageous for learners if used correctly. This is why it has become a primary aspect of modern education and an integrated component of contemporary teaching strategies (Voogt et al., 2012).

Learning theories and frameworks relevant to geography education

In the theories of constructivism and social constructivism, knowledge is constructed by adapting new ideas and information based on prior experience and knowledge (Schunk, DH, 2012). Collaborative technologies enable constructivist learning environments in which students can work together to develop their own understanding. Collaborative learning is a key component of constructivism, so learners can work together to find the answers using platforms that provide for these opportunities in applied geography, such as Google Earth. ICT tools can enable learner-centric learning strategies (Harris, 2002). Learner-centric strategies benefit students because they give them the chance to explore creative ideas, strengthen interaction skills, and broaden their ways of thinking (Luckin, 2008). The most common smart applications in schools are, currently, laptop work, electronic learning software, intelligent classrooms, didactic resources, and cognitive stimulation—these things are all important for modern education (Umar & Jalil, 2012).

Heutagogy is one of the most recent contributions to explore how we think about designing student-centered learning experiences. “Heutagogy is the study of self-determined learning and applies a holistic approach to developing learner capabilities” (Blaschke & Hase, 2019, p. 1). The core of Heutagogy is developing learner agency, enabling the learner to take responsibility or negotiate the learning outcomes and pathway, while teachers facilitate a supportive learning environment (Blaschke & Hase, 2019; Moore, 2020) that builds digital capabilities. Digital capabilities have six elements: ICT proficiency; information data and media literacies; digital creation, problem solving, and innovation; digital communication collaboration and participation; digital learning and development; and digital identity and wellbeing (JISC, 2017).

Experiential learning is another powerful pedagogical strategy. Luckmann (1996) defined experiential learning as “a process through which a learner constructs knowledge, skills, and value from direct experiences” (p. 1). In the discipline of geography, utilizing the method of experiential learning can assist in converting in-person classes to online or distant formats. For example asking students to discover the area around them by using Google Earth, and then they can talk to each other about their findings.

Research Gap

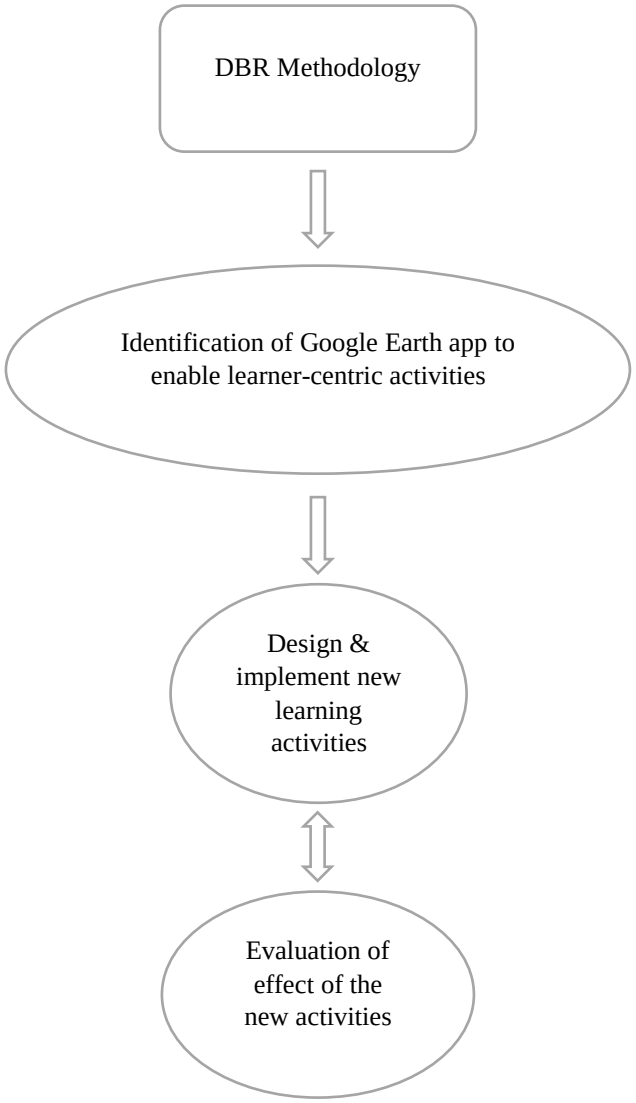
The body of current studies offers an in-depth understanding of the possible advantages and difficulties of ICT in education, especially in the field of geography. Nevertheless, there are not many thorough studies that expressly address how ICT tools affect secondary school students' geographic learning outcomes. School-based geography education is still based on traditional methods of learning and teaching geography, leading to disengagement in learning geography. As a result of this, many students regard the geography subject as complex and difficult to understand, particularly in secondary school. Therefore, this research explores new methods of teaching and learning about the subject of geography. This study's research aims to increase students’ motivation towards using ICT tools such as the Google Earth app in learning geography in secondary schools. In terms of the use of Google Earth for learning and teaching geography, this research seeks to address the two following questions:

RQ 1: To what extent do ICT tools such as Google Earth impact learning geography among fifth-grade secondary school students?
RQ 2: In what ways do immersive field trips as ICT tools motivate students to learn geography in secondary schools?

Research Design and Methodology

The research design was framed by the use of design-based research (DBR) methodology (Author2 et al., 2016). DBR was chosen as it focuses upon identifying and solving pedagogical problems through a collaborative authentic learning design and evaluation process (McKenney and Reeves, 2018). This research involved a collaboration between the lecturer and the students, following the three phases of DBR: identification of the relevance of the Google Earth App, designing new learning activities, followed by an evaluation of the effect of the new activities and assessing their impact on students' motivation and learning in immersive learning environments (Figure 1).

***Figure 1*: Flowchart of phases of DBR Methodology (Source: Researcher's own design)**



Participants who took part in the study were asked to complete the survey, which was utilized as a method to gather data following ethics consent procedures. The research used a mixed-methods qualitative and quantitative strategy. A qualitative survey (a questionnaire, Appendix 1) method was deployed to establish learner feedback on the impact of ICT on secondary school students' learning of geography.

Study sample and population

The research sample consisted of students from three public secondary schools in Iraq (two of them situated in the center of the city of Diyala Governorate and the other one in a rural area). The researcher randomly selected the sample, which consisted of 100 fifth-grade students (males and females) from a total of 450 students from the three schools, and the students who participated in this research were volunteers.

Implementation phase

The course timeframe consisted of two months with the intention of teaching the students the geography subjects for fifth grade in secondary schools. The researcher implemented the use of virtual field trips via Google Earth in geography lessons with an intervention group of 100 students, allowing the learners to explore the area around them through the use of the Google Earth app. The class discussion was actively opened among the students in the next lesson, based on what they achieved from the results, to enable them to discover specific geographical areas and then share these results before learning about distinct geographical phenomena in the subsequent in-person lesson. The researcher observed that students were more motivated and engaged with this process of learning. In contrast to the intervention group, non-intervention group learners were not engaged and motivated enough with the traditional geography lessons in face-to-face classes. The intervention group illustrated that digital learning environments such as the Google Earth App enable students to learn online by depending on themselves rather than on their teachers and by doing exercises that require problem-solving tasks in real-world environments (Blaschke & Hase, 2019; Moore, 2020).

The activities involved (1) how to navigate around the earth and move from place to place using the tools of the Google Earth App, such as street view, location, 3D view of mountains, and 360-degree interactive photos, (2) how to explore geographic features and search for locations such as cities, rivers, valleys, mountains, and deserts (3) virtual field trips to visit well-known landmarks, places, historical cities and taking interactive maps and photoshoots as well as (4) mapping activities, creating their own modified maps on Google Earth; and (5) creating research assignments where learners can add texts, geolocated points of interest and share maps and related stories.

Ethics Consent and Data Collection Instrument

To achieve the study's aim, Bera (2011) suggested that “educational researchers should operate within an ethic of respect for any persons involved in the research they are undertaking” (p. 5). Before starting any data collection, approval was obtained from the headteachers of those three schools to embark on data collection for the research. Then, ethical procedures were followed by ensuring issues such as anonymity and confidentiality in this research, and all participants were informed that their participation would be voluntary and anonymous. Consent forms were used to inform the participants about the aim and title of the research and included the statement. “By completing this survey, you are giving your consent that your data will be collected to be used within academic research”. Next, the questionnaire was distributed to the students with a short introduction of the research terms, such as Google Earth (virtual field trips and photoshoots for places), as an ICT tool, and its effectiveness. The tool for assembling quantitative data involved a motivation scale questionnaire. The questionnaire was tested and evaluated by invited experts before implementation. Finally, the questionnaire included three sections. Section (A) consists of five items aimed at gathering the detailed demographic information of participants. Section (B) consists of 12 items on students’ experiences using ICT tools in geography lessons. Section (C) consists of 7 items on students’ motivation towards using ICT tools. The questionnaire, therefore, consists of 19 items in total (see Appendix A).

To measure the reliability of the study with regards to the questionnaire, Cronbach’s alpha test was used to assess that the data is up-to-date, which was collected from the questionnaire, and the result was (0, 76), a value that is acceptable (Miller & Acton, 2009).

Results

Data were analyzed using the statistical program SPSS and descriptive statistics. These were used to analyze the demographics of the 100 intervention participants and the three domains of the questionnaire (Tables 3, 4, and 6-7). Statistical tools were used, such as the T-test, Pearson correlation, and one-way ANOVA test, as shown in the following tables (Tables 1–12). The implications of this analysis are discussed in the following discussion section.

Table 1: T-test for equality of M Levene's

No	**Mix**		**Min**		***p value***	***t value***	**Sig(2-tailed)**
	Mean	SD	Mean	SD			
1	3,26	1,43	2,59	0,46	2,21	2	0,031
2	4,48	0,70	3,48	0,46	2,21		0,000
3	4,56	0,51	3,48	0,89	5,44		0,000
4	4,41	0,69	3	1,33	4,88		0,000
5	4,52	0,51	3,56	0,85	5,06		0,000
6	4,41	0,97	3,15	1,32	3,99		0,000
7	4,22	0,58	2,93	1,11	5,40		0,000
8	4,70	0,47	3,37	0,97	6,46		0,000
9	4,04	1,06	2,59	0,89	5,44		0,000
10	4,22	0,64	3,26	1,02	4,15		0,000
11	4,11	0,70	2,74	1,38	4,62		0,000
12	4,85	0,36	4,04	0,65	5,70		0,000
13	4,33	0,68	2,81	1,08	6,20		0,000
14	3,33	1,21	2,19	0,96	3,86		0,000
15	4,37	1,01	3,26	1,13	3,82		0,000
16	3.30	1,17	2,22	0,81	3,94		0,000
17	3,33	1,44	1,96	0,81	4,31		0,000
18	3,22	1,34	2,33	0,96	2,80		0,007
19	4,15	1,06	3	1,27	3,60		0,001

DF: 52

Table 1 shows (M, SD, with p and t values) for two research samples (mix and min) on scale (discrimination coefficients).

Table 2: Statistical correlations between (p and t) the paragraph relationship with scale

No	***P***	***T***	***df***	**Sig**
1	0,280	0,19	*	0,005
2	0,518		*	0,000
3	0,485		*	0,000
4	0,586		*	0,000
5	0,458		*	0,000
6	0,428		*	0,000
7	0,526		*	0,000
8	0,556		*	0,000
9	0,580		*	0,000
10	0,535		*	0,000
11	0,481		*	0,000
12	0,482		*	0,001
13	0,651		*	0,001
14	0,227		*	0,002
15	0,397		*	0,000
16	0,464		*	0,000
17	0,308		*	0,002
18	0,282		*	0,004
19	0,470		*	0,000

DF: 98 *

Table 3: Statistical Correlation between (the relationship of the paragraph with the domain)

No	*P*	*T*	Sig	*SL*
Domain 1				
1	0,237	0,19	*	0,017
2	0,583			0,000
3	0,543			0,000
4	0,636			0,000
5	0,516			0,000
6	0,553			0,000
7	0,608			0,000
8	0,584			0,000
9	0,559			0,000
10	0,575			0,000
11	0,590			0,000
12	0,614			0,000
Domain 2				
13	0,632			0,000
14	0,567			0,000
15	0,658			0,000
Domain 3				
16	0,641			0,000
17	0,679			0,000
18	0,514			0,000
19	0,619			0,000

DF: 98

Table 4: Statistical Correlation between the Three Domains.

	Domain 1	Domain 2	Domain 3
CC	0,900	0,608	0,611
Sig	0,000	0,000	0,000

Table 5: Statistical Indicator for Scale.

Statistical indicator	Value
Mean	67.99
Std. Error	0.847
Median	96
Mode	73
Std. deviation	8.473
Variance	71.808
Skewness	0.276
Kurtisios	0.107
Rang	43
Minimum	45
Maximum	88

Figure 2: Histogram of the research's sample *(*Source: the researcher, based on data collected from SPSS).

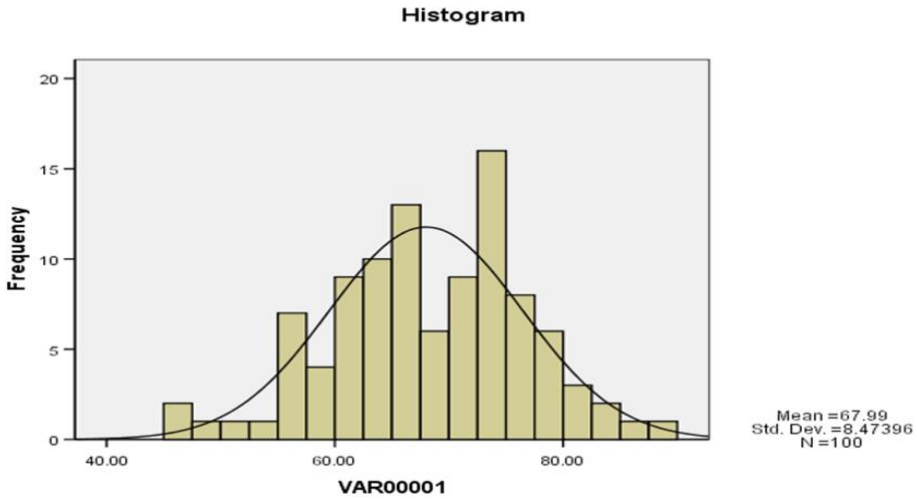


Table 6: P and T values for the research sample to what extent the impact of ICT tools on motivation scale (Questionnaire)

Sample	N	Mean	SD	WM	P	T	DF	Sig	SL
	100	67.99	8.473	57	12.97	1.98	99	*	0.000

Table (6) shows that the difference was statistically significant (p=12.97 > t=1.98) with (SD=8.473), (DF=99) and SL (0.05) and (Mean score= 67.99 > WM=57).

Table (7) P and T values for the research sample to what extent the impact of ICT on the domain of using ICT tools in learning geography

Sample	N	Mean	SD	WM	P	T	DF	Sig	SL
	100	44.87	6.17	36	14.38	1.98	99	*	0.000

Table (7) shows that the difference was statistically significant (p=14.38 > t=1.98), (SD=6.17), (DF=99) at SL (0, 05), and (M=44.87 > WM=36).

Table 8: M, SD, WM, P, and T values of students' motivation towards ICTs

Group	N	Mean	SD	WM	P	T	DF	Sig	SL
	100	10.88	1.95	9	9.64	1.98	99	*	0.000

Table (8) shows that the difference was statistically significant (p=9.64 > t=1.98), (SD=1.95), (DF=99) at SL (0, 05) and (M=10.88 > WM=9).

Table 9: M, SD, WM, P, and T values for the impact of experience (*) on students' motivation

Group	N	Mean	SD	WM	P	T	DF	Sig	SL
	100	12.24	2.84	12	0.845	1.98	99	No	0.578

* It means a student who has skills in using digital technology.

Table 9 indicates that (t=1.98 > p=0.845), (SD=2.84), (DF=99) at SL (0, 05). Therefore, the difference was not statistically significant for the experience (*) on students' motivation.

Table 10: M, SD, T, and P values for gender (males and females) to assess the impact of ICT on motivation.

Gender	N	Mean	SD	*P*	*T*	*DF*	*SL*	Sig
Male	68	67.44	9.11	0.944	1.98	98	0.348	No
Female	32	69.16	6.93					

Table 10 shows that the difference was not statistically significant (t=1.98 > p=0.944) for gender (males and females).

Table 11: M and SD for age categories

Categories	**N**	**Mean**	***SD***
15 years	4	66	5.89
16 years	7	69.29	13.01
17 years	37	68.11	8.38
18 years	35	68.03	8.16
19 years	17	67.06	8.72

Table 12: One-way ANOVA test for age groups on motivation scale (questionnaire)

	Sum of squares	***DF***	**Mean square**	***F value***	***SL***	**Sig**
Between groups	42.091	4	10.523	0.140	0.967	No
Within groups	7128.909	95	75.041			
Total	7171.000	99				

Table (12) shows the results of the mono-variance analysis for age categories on the motivation scale (t = 2.44 > f = 0.140) at SL (0.05) and DF (95.4). Thus, the difference was not statistically significant between age categories.

Discussion

In terms of to what extent the impact of using ICT tools has on learning geography in secondary schools, the first research question "To what extent do ICT tools such as Google Earth impact learning geography among fifth-grade secondary school students" can be answered. The results of analysis of the survey feedback from the participating students show that the difference is statistically significant (Tables 6-7), which means that the use of Google Earth as ICT tools has a positive effect on students' learning. This indicates that the use of ICT tools represented by Google Earth has increased the motivation of students to learn geography at the secondary level (Table 8). This finding corresponds with numerous studies stating that the use of ICT tools, for instance, Google Earth has a positive impact on students' motivation in primary and secondary schools (Higgins, 2003; Reynolds et al., 2003; Passey and Goodison, 2004; Tuzun et al., 2008; Balanskat, 2006; Garyfallidou & Ioannidis, 2014; Alan, 2017; Razak et al., 2018; Butter et al., 2019; Shen et al., 2022).

As for the second question, "In what ways do immersive field trips as ICT tools motivate students to learn geography in secondary schools?" This study, therefore, found that immersive virtual reality technology tools represented by Google Earth affect students' motivation and learning of geography—and indeed, that ICT tools have a positive effect on students' motivation in their study of geography. The students were motivated and enjoyed studying natural and human geographical concepts and phenomena digitally through Google Virtual Trips (GVT) at home and in the classroom, as confirmed in several studies (Harris & Kington, 2002; Passig & Goodison, 2004; Tuzun et al., 2008; Hwang & Chen, 2016). With the use of virtual reality technology, Shen et al. (2022) confirmed that students can completely experience the stunning and unusual geographic regions by submerging their visual, aural, and other senses into the reality of immersive virtual environments. Additionally, by using these sensory cues, storytellers and listeners can more effectively and easily comprehend the nature of difficult ideas and concepts. Thus, this evidence is consistent with the results of the current study that immersive experiences contribute to a deeper understanding of complex geography concepts via the use of Google Earth in the learning of geography.

In terms of the impact of confidence on student motivation, the results indicate that students are confident in using digital devices such as computers, internet access, and digital maps in learning geography, and this confidence is motivating students to learn geography using ICT tools. However, in this current research, student experience does not affect learner motivation (Table 9). These results were consistent with previous studies mentioned in the literature review (see, e.g., Harris & Kington, 2002; Sampaio & Almeida, 2016). Further results indicate that

factors related to gender (males and females) also do not impact the learner's motivation to learn geography (Table 10). Furthermore, findings indicated that the difference was not statistically significant for age categories (between and within groups) on the scale of motivation (Tables 11–12).

Within the context of the coronavirus pandemic, the educational contents were delivered online, such as through Google Meet, Google Classrooms, FCC, social media platforms, and virtual classes, etc. ICT tools are now a vital component of teaching and learning. Effective and appropriate education in geography requires the provision of innovative and effective educational strategies, so this study also reinforces the use of flexible and adaptive classrooms in geography education. Covid-19 accelerated the adoption of distance education and the implementation of experimental and self-directed learning strategies. Therefore, this study indicates that experiential and self-directed learning strategies are especially significant in learning and teaching geography. Specifically, the findings show that the use of ICT tools such as Google Expeditions and Google Maps positively impacted the motivation of students to learn geography in the fifth grade in secondary schools in Iraq. This has contributed to ICT tools having a positive impact on students' motivation towards the use of digital technologies. The research shows ICT-based flexible educational classrooms are advanced learning environments that use digital means and emerging technology to create a more effective and personalized educational experience, improve learners' interaction and motivation towards the learning process, and specialize education according to the needs of each learner in the current digital age, such as virtual field trips.

Limitations

Despite the valuable results provided by this study in exploring the real impact of ICT tools on secondary school students' learning of geography, it is worth noting some limitations. A relatively small sample size and a limited geographical area were used for this study, which focused on three different schools in Iraq. Different educational and geographical environments may affect the generalizability of the results of this study. As well as perhaps technical problems that lead to disruption of the effective use of the Google application, for example, poor Internet, malfunction of digital devices, and difficulty in using the application, and all of this in turn may affect the students' learning experience. Therefore, it is necessary to ensure the existence of an integrated digital infrastructure to conduct future studies.

Conclusion and Recommendation

Exploring the profound impact of ICT tools' effects on students' motivation and the learning of geography in secondary schools is highly recommended in educational research. This study introduces novelty by investigating the unique impact of ICT tools, including the Google Earth App, on fifth-grade students' motivation and geography learning in secondary schools. Its distinctive contribution lies in providing an empirical model for analyzing the impact of ICT tools used on students learning, showcasing the crucial role of technology in overcoming educational disruptions and fostering online learning. The results of this study provide a new perspective towards the importance of using ICT tools, especially the Google Earth app, to integrate geography education curricula by focusing on innovative learning approaches such as experiential and determined learning strategies. The utilization of cutting-edge ICT tools, like immersive virtual reality and digital technology, needs to supplement and improve conventional instructional practices in the discipline of geography. Students' collaboration can be enhanced using technology-based learning tools (e.g., the Google Earth App in learning geography). The study indicates that digital technologies such as the Google Earth app can be used as an innovative method to help learners learn geography and enhance their motivation and confidence. Moreover, as a result of COVID-19, flexible and smart educational curricula should be designed to meet the requirements and needs of future learners, especially educational curricula based on intelligent adaptive learning. This research confirms that the use of ICT tools has positive effects on students' motivation and the learning of geography because of the application of experiential and self-determined learning strategies in geography. As the findings show, we can conclude that the use of ICT tools such as virtual field trips has impacted the motivation of learners in learning geography for fifth grade students in secondary schools.

Future research: It is recommended to investigate the impact of using experiential learning strategies on students' motivation and achievement in learning geography through integrating GIS and geolocation applications in learning experiences. To achieve this the study recommends incorporating digital and professional competencies in geography teacher training to prepare them for designing smart, flexible classrooms that cater to learners' needs in the digital age, developing GPACK (Geography Pedagogical and Content Knowledge). In addition, curricula and teaching methods need to be adaptable to keep up with rapid developments in emerging technology, such as

artificial intelligence tools in learning geography and designing curricula based on intelligence-adaptive learning and designing flexible educational classes in geography that can be adapted according to the requirements and needs of the learners.

Open Data

The data will be available for free when requested.

Conflicts of Interest

There is no conflict of interest, explicitly.

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Appendix A (Questionnaire)

Introduction

Thank you for agreeing to participate in this survey, which will take approximately 10 minutes. The information you provide will be kept confidential and anonymized. It will only be used for a report that will be written based on the anonymized data for my research. Your participation is completely voluntary. This means that you can withdraw at any point you feel you want to. In addition, if you feel uncomfortable or don't want to answer a single question, you can move on to the next ones. Your participation, however, is very important to me because you will contribute useful information that will help me investigate the extent to which 'the real impact of using ICT tools in learning geography for fifth grade literary'.

A- General information about participants

- Your gender (male or female)
- Age group (14 years, 15 years, 16 years, 17 years, 18 years, 19 years)
- What do you consider your level in geography to be?
- (High 2; Middle 3; Weak 4; Do Not Know)
- What do you consider your level in digital technologies to be?
- (1-High 2- middle 3-weak 4- do not know)
- Do you enjoy geography lessons? (1-sometimes, 2-always, 3-never)

B- Your experience using ICT tools such as Google Earth in learning geography?

- Thinking of using the Google Earth app in geography lessons, to what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1- Digital technologies like Google Earth app provides many challenging materials?	1	**2**	3	4	5
2- I like using Google Earth for study purposes?	1	2	3	4	5
3- I would like to study geography by the Google Earth using interactive maps?	1	2	3	4	5
4- Using Google Earth tools makes my interested during the class?	1	2	3	4	5
5- I feel motivated when I use the virtual field trips in the lesson?	1	2	3	4	5
6- A geography lesson is more enjoyable with the Google Earth app?	1	2	3	4	5
7- Immersive virtual trips use makes my more enthusiastic to attend geography classes?	1	2	3	4	5
8- I like to use Google Earth app because it helps me to do my jobs more batter?	1	2	3	4	5
9- I would like to show my friends, how I can accomplish my homework through Google Earth app?	1	2	3	4	5
10- Using virtual field trips helps me show my colleagues and teachers my ability to participate in geography class discussion?	1	2	3	4	5
11- Is it possibility to apply immersive virtual experiences using Google Earth skills in geography to other lessons?	1	2	3	4	5

12- ICT tools skills are beneficial in my future studies?	1	2	3	4	5

(Please select one for each question)

C- Students' motivation towards the use of ICT tools in learning geography.

- In your experience with computer programs, to what extent do you agree or disagree with the following statements?

(Please select one for each question)

	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
1- I feel more motivated when I answer on tasks by using virtual field trips?	1	2	3	4	5
2- When I learn new educational activities using Google Earth on my computer, does that increase my motivation towards its use in learning?	1	2	3	4	5
3- Is it easy to solve errors using ICT tools?	1	2	3	4	5
4- I feel more motivated when I use the Google Earth app to seek out geography information?	1	2	3	4	5
5- Is it easy to use Google Earth to find out geographic features?	1	2	3	4	5
6- Is it important to use virtual field trips when learning geography?	1	2	3	4	5
7- I would like to learn geography using the Google Earth app in the future?	1	2	3	4	5

Thank you for your time and participation.