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Original Paper

The Impact of Virtual Trips on Lateral Thinking and Middle School Student's Achievement

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Abstract

The current research aims to find the effect of virtual trips on lateral thinking and achievement of 1st-year intermediate school students in chemistry. So (65) female students studying in one of Baghdad's public schools were randomly selected as participants. The class was randomly divided into two groups, the experimental group which represented the Virtual Field Trip (VFT), consisting of (33) participating female students, and the control one, which consisted of (32). Researchers combined two research tools, the lateral thinking scale consisted of (30) items that included lateral thinking skills [thinking outside the box, critical analysis, creativity, orientation towards solutions]; and the achievement test consisted of (40) objective multiple-choice items with four alternatives. The results showed that the use of (VFT) enhanced the chemistry achievements, and recommended conducting more comprehensive educational experiments related to males to confirm the results of the study and expand the scope of this new education.

Keywords: Virtual trips VT, lateral thinking, achievement, students, Middle School

1. Introduction

The College of Education for Pure Sciences in Baghdad has achieved great developments in various fields, including computer laboratories, teaching techniques, curricula, and practical exercises. More recently, given the limited access and opportunities available to Iraqi students to visit famous sites, this study offers the possibility of exploring many of these sites virtually via the Internet. The advancement of educational technology in recent years has led to interest in teaching methods integrated into the curriculum, including the use of virtual technology, due to its ability to provide flexible scheduling, reduce environmental impact, and provide information without physical restrictions. Specifically, virtual field trips mimic real-life trips online, it is a relatively uncommon technique in chemistry education and is largely unfamiliar to Iraqi students. Virtual reality requires the creation of a variety of educational devices, such as virtual reality glasses that are very affordable, such as Google Cardboard, which provides fun interactive educational experiences, and interactive simulation laboratory teaching platforms. The concepts of virtual reality and virtual tours (VTs) have received significant focus in various industries, including tourism, education, construction and entertainment (Majeed, 2022; Al-Ansi et al., 2023). In the field of science education, virtual trips provide learners with the opportunity to participate in virtual experiences that are more flexible and convenient than familiar on-site activities. Access to virtual equipment can significantly reduce the cost and logistical barriers associated with physical activities. This adaptability allows for adapting to new educational objectives and enhancing teaching methods (Klippel et al., 2020).

In addition, VTs can expose students to more content and introduce more experimental procedures that would otherwise be limited. The virtual experience of teaching content addresses the diversity of students' backgrounds. Students can personally engage in a wide range and meaningful educational experience at home or abroad. Teaching in science, sensing, tools and paraphrasing follows (Petersen et al., 2020).

The virtual experience is more effective than the explanation, as students interact differently with

virtual learning compared to physical learning (Al-Nouri, 2014). Through virtual travel experiences, they study real-world situations and make decisions in virtual situations (Seifan et al., 2020). Through this experience, students gain a mixed variety of perspectives on everyday life or mechanical processes, which enables them to make some connections and provides fertile ground for lifelong learning (Dede & Richards, 2020). Virtual reality (VR) technology has developed rapidly in recent years. The rapid technological development of virtual reality has created exciting opportunities in the reality of teaching and learning (LegeEuan & Bonner, 2020). So one of the characteristics of VR is the ability to simulate real-world experiences, researchers consider VR an effective tool for enhancing students' learning experiences, increasing student engagement, and expanding classroom walls (McGovern & Moreira, 2020). Virtual reality is not limited by time and space, and there are no restrictions to affect any student's learning; and VR technology allows students to focus on important learning content through VR emotions and encourages students to become more proactive in exploring the subject (Asad et al., 2020).

The modern educational environment requires the development of higher-order thinking skills for students, such as problem solving, lateral and critical thinking, decision-making, metacognitive thinking, and communication skills (ALRikabi, 2021; Ameen, 2024). It is an important role of education to guide students in obtaining opportunities, the contemporary approach to teaching chemistry has moved beyond monotonous lectures given by professors. This is a new interactive method that often takes place outside the confines of the traditional classroom. These trips aim to enhance scientific understanding through hands-on experiences. While these physical field trips provide students with valuable knowledge and skills not typically obtained in a formal classroom setting, they also come with significant direct and/or indirect costs for both students and teachers in Iraq. The field of chemistry education, especially in the educational field in Baghdad, is guided by experienced chemistry teachers who invite comprehensive field trips for students (Treiblmaier et al., 2018). The trips are limited to visiting places or factories for recycling waste, especially aluminum, and extracting noble elements, as well as university research laboratories, which are restricted due to safety and security concerns. Considering these restrictions, there is a quest for educational trips that go beyond the constraints of traditional field trips and have the potential to enhance academic achievement and lateral thinking skills.

Online Journeys provides a new approach for students to delve into online experiences. Not every academic field can easily incorporate traditional field trips, especially in the field of experimental science that focuses on microscopy. Real-life trips to industrial environments or chemical facilities may pose potential risks to inexperienced students (Jiangyue et al. ,2022); logistical obstacles often hamper the feasibility of traditional field trips. While researchers often explore changes and innovations in actual field trips, there is a paucity of studies that address new experiences using virtual field trips (Landa et al., 2020). While previous studies have emphasized the potential advantages of virtual field trips for educational purposes, their integration into global curricula remains limited, with the reasons behind them not being fully explored in the existing literature (Klippel et al., 2020). Virtual field trips hold promise for enhancing students' understanding of their studies by making connections between lessons and different objects, locations, or environments. Educational trips or simulation experiments can provide valuable learning opportunities by immersing students in authentic, real-world scenarios within the scope of chemistry experiments that would pose safety risks or incur high expenses if conducted in a traditional laboratory setting. This study Virtual Journeys for Chemistry offers abundant opportunities for active learning across diverse learning environments. Chemistry in general serves as the foundational foundation for the chemical components that are integrated into both biology and health sciences at all levels of education. Teachers find it necessary to incorporate chemical principles, such as polarity and intermolecular forces, to capture students' interest. An important educational role is to guide students to opportunities to engage in the development and application of higher order thinking skills. Using virtual reality, students use cognitive imagination to understand abstract concepts, reducing the gap between abstract concepts and learning practice (Pflieger et al., 2024). The virtual experience of teaching content addresses the diversity of students' backgrounds. Students can personally engage in a wide range and meaningful educational experience at home or abroad. Teaching in science, sensing, tools and paraphrasing follows (Chen & Liu, 2020).

The virtual experience is more effective than explanation, as students interact differently with virtual education compared to teaching physical events. Through virtual experiences, they study real-world situations and make decisions in hypothetical situations. (Papadakis & Kalogiannakis, 2020).

Although chemistry is an exciting basic science and its influence is evident in regular activities, many students generally show a lack of interest in the obstacles facing society. The results can be useful to researchers, policy makers, teachers, educators, parents and the local community so the purpose of this research is to examine the importance of virtual field trips. (VFTs) in enhancing chemistry achievement results among first-class intermediate female students, as well as their lateral thinking, compared to students who study using traditional methods. The researchers used the experimental method and to achieve the objectives of the study, so they posed the following research questions:

(a) Are there statistically significant differences at $\alpha \geq 0.05$ in chemistry achievement between the control group for the virtual trips and the experimental group that used field trips for female students?

(b) Are there statistically significant differences at $\alpha \geq 0.05$ in lateral thinking between the control group for the virtual trips and the experimental group that used field trips for female students?

2. Theoretical Framework

2.1 Cognitive Learning Theory

Which aims to discover the factors that contribute to an individual's knowledge and understanding. The central question of cognitive theory is twofold: To what extent learners learn best with the following factors: principles (form/background, multiple representations, context, differences between experts and novices, metacognition), clear examples, concrete support, initial questions and diverse learning conditions (Schneider et al., 2022; Hassan, 2023). The principles of cognitive learning will be reflected in the design of educational materials used in the study in unconventional ways. These materials are specifically designed for a digital (virtual) chemistry learning environment. The virtual lesson design is an attempt to activate students' prior knowledge (Theory of Mind) because this theory has become a subject of great interest in the design of educational materials (Han, 2020).

The new design will activate teachers and students and based on constructivist theory; students will try to create a mental image of things around them to help them learn chemistry. Hence, to create something, learners must try (Seifan et al., 2020). In the study, the effort is focused on three methods. For example, visual contact leads to better learning outcomes for students. Default 3D mode. The third dimension in virtual VFT is 3D chemistry. Combined with students' understanding and explanation in VFT audio communication, the outcomes of the lessons were enhanced (Kim et al. 2022).

In chemical language, making comparisons and contrasts between different elements or topics is known as lateral thinking. This is because language and thought are difficult to separate. Lateral thinking is useful in both subjects and to help students who have linear thinking (Ezzel-deen, 2023). That learning must be observed in carefully controlled atmospheres and that the emphasis on the student's mental processes is never obvious. Learning cannot be separated from the cognitive process. Researchers studying cognitive development have assumed that the different stages of development are driven by interactions between a person, his or her social companions, and cultural tools. A person's internal state is critical, where thinking, problem solving and logical thinking are concerned. Knowledge ownership is mentioned as an individual's cognitive acquisition by (Romisowski & Mason, 2004). Cognitive processes are used to process, store, and use information (Kucharska & Erickson, 2023); also uses symbolic processes to represent information, rather than neural connections. In a series of computer networks using symbolic processing, the choice of this type of representation depends on the purpose of the learning environment designers (Castro & Siew, 2020, Al-Malah, 2023).

In the context of this study, cognitive learning theory allows us to see the effects of virtual field trips on a person's mental processes, with a particular focus on gaining new knowledge and improving lateral thinking abilities, Virtual Field Trip is a website with images and sounds of real places (Patiar et al., 2020, Alnoori, 2024).

Some of the websites are multimedia presentations, but most are photo archives. These websites are great for showing students places they wouldn't have had a chance to see otherwise, how big the places

are, and what they look like. Allows students to recall information and examine local sites to create their own virtual field trip (Liu et al., 2022).

2.2 Constructivist Theory

The importance of this theory is that the learner will understand new knowledge easily and effectively through learning that is based on discovery, practical activities, and searching for solutions to problems as an active learner. Moreover, this theory bases its principles on how the acquisition of new knowledge is linked to the learner's previous experience. In addition, knowledge is constructed through the learner's attempts to organize new knowledge by linking it to previous knowledge (Klippel et al., 2020).

The principle of this theory explains the different learning experiences of individual learners. The virtual field trip is consistent with the principles of the theory, and one researcher concluded that learning based on constructivist learning theory would have a positive impact on the learner's achievement and previous experience and would also contribute to changing the educational trip for the better as it is an active process. And effective (Makransky & Mayer, 2022). Also it explains the different learning experiences of individual learners. According to (Ertmer & Newby, 1993), the virtual field trip is consistent with the principles of the theory, and one researcher concluded that learning based on constructivist learning theory would have a positive impact on the learner's achievement and previous experience and would also contribute to change the educational trip for the better as it is an active process and effective.

2.3 Previous Studies

2.3.1 Virtual trips: including

- (Al-Juhani, 2016) "The effectiveness of the strategy of cognitive trips via the web in academic achievement and attitude towards science among fourth-grade female students." This study showed that using these cognitive strategies through the web improved academic achievement and attitude toward science.

- (Mohamed, 2018) "Lateral thinking and its impact on improving problem-solving skills among secondary school students." The study sample consisted of 200 high school students in different schools. The study showed that training students to use lateral thinking led to a noticeable improvement in their problem-solving skills. Problems. Students who received training in lateral thinking were more able to think in unconventional ways and find innovative solutions to the problems they faced.

- (Mabad, 2019) "The effectiveness of cognitive trips via the web (individual/collaborative) in developing teaching competencies and satisfaction with the e-learning environment among student teachers at Suez University." The study sample was 145 male and female students at Suez University, who contributed to improving teaching competencies. Satisfaction with the e-learning environment among student teachers.

Studies on virtual field trips have found that virtual field trips are just as fulfilling as a traditional field trip. In addition, the practical lessons in the real environment and the practical lesson that takes place in the virtual environment of the field trip affected the students' achievement. Bock (2009) reported the results of a field experiment examining the effects of an educational tool to support science inquiry learning known as "virtual field trips" on school students' science achievement, perceptions of science learning, memories, and interests (Akman, 2023).

2.3.2 Lateral thinking, including:

- (Abdel Ghaffar & Mahmoud, 2016) "Creative and lateral thinking in solving problems and their relationship to some demographic variables." The study sample was composed of 656 male and female students from the first- and third-year levels from different Egyptian universities (Ain Shams, Menoufia, Al-Azhar); it showed that the college sample was characterized by a low level of creative and lateral thinking ability, while there was a high level of problem-solving ability.

2.4 Virtual Field Trips in Education

Virtual field trips (VFTs) allow students to explore any physical or non-physical location around the world without having to physically leave the classroom. In doing so, regardless of the level of FIR visited (i.e. flora, fauna, geological, historical or industrial), Especially in times of virus outbreaks, cost-cutting, equal access to parts of the world that students may never visit (NG,2023). However, the development and dissemination of (VFTs) does not come without its own challenges, for example, moving away from ideals such as receiving fewer grants or in-kind donations, timeliness, coordination, and disparities between those who are not computer literate and those who are not. On the mobile phone, avoiding the computer if it is not available to some, and the like (Doore & Baughman, 2023). Thus while the literature agrees that VFTs conducted for school-age students are recommended as a preparation guide before taking a field trip during or after visiting a specific physical site, little research has been conducted on investigating virtual tours for immersion in laboratory work.

One of these is if participants using VFTs are likely to change their subject/technique choices in future choices in the same field, an effective way to boost student morale is to suggest a planned field trip to be taken later in the semester at school or in It's time for the students themselves to come. themselves. Chemistry education is concerned with finding new ways to teach simple scientific theories to students who need to use their knowledge in their daily routine. To be able to adapt these theories to many different scientific issues, students need to find a way of learning that helps them generalize the direction of chemistry theories.

2.5 Lateral Thinking in Education

Awareness of lateral thinking in education refers to creativity. Teachers cannot teach critical thinking using a set method or a step-by-step program. Therefore, stimulating and engaging creative and lateral thinking is essential to implementing a successful critical thinking program. The focus will be on how to get students to think creatively, innovatively, and divergently. They face many alternatives in different ways. Creativity is viewed as a person's ability to produce innovative, different, unusual, playful, imaginative and abstract ideas, as well as according to the principles or problems he faces. Such creative thinking is directed towards exploration, sensitivity (flexibility) and originality) (Sawyer & Henriksen, 2024). While lateral thinking is the process of exploring a problem by exploring different alternatives. Lateral thinking is future thinking. Thinking outside the box moves the basis of lateral thinking from effect to cause to come up with new ideas, with the premise that there is no relationship between cause and effect, and there is no sequence of rule-based thinking (Mustafa & Hedaya, 2020).

Lateral thinking will not change facts or assumptions, it is a way of dealing with facts and arriving at rational and complex conclusions. In other words, lateral thinking is an approach used to explore new and innovative ideas in the world of education (Srikongchan et al., 2021). Using lateral thinking is very useful in educational materials so that students are active and creativity oriented. It is a fun, creative, and multidisciplinary mental activity that is not bound by common sense or standard logic (Tang et al., 2020). Lateral thinking is a way to learn science; it can be defined as a method of finding a solution to a problem by changing the usual way of thinking and not involving precise or scientific thinking. We propose for the first time lateral thinking tests as an additional tool for diagnosing achievement in chemistry in University of Baghdad.

3. Methodology

This research uses two main dimensions to support the goal of achieving the best impact of using virtual reality field trips in teaching chemistry: lateral thinking skills and achievement in chemistry; and the extent to which they are affected by reality. Using experimental design; this research aimed to study the impact of virtual field trips (VFTs) supplemented with Hyper Videos on the lateral thinking skills and the achievement of chemistry among first-class middle school female students in Al-Karkh Al-Awal / Baghdad – Iraq (Hammadi, 2023; Hassan, 2023). The actual research design included following the experimental study. Virtual field trips were used. Here in this research, the VFTs application “studio. panoee. projects” is used and the Virtual Field Trips application is also used. As an alternative to traditional field trips to chemical production plants and to chemistry laboratories, it allows students to explore these places in a way that makes the lessons interactive and engaging. It

includes videos, links to additional resources, and pictures. It helps students' interest in the subject, and activities that should be learned and taught traditionally are also considered. On the other hand, the control group was taught using the traditional teaching method. The lessons were taught using PowerPoint, textbooks, worksheets, blackboards, and teacher statements for the control group (Taban & Mİmamoğlu, 2023).

The research population was chosen from first-year middle school students (aged 12 to 13 years). It consisted of 65 female students from a school in Baghdad-1st Al-Karkh /Iraq, in the academic year (2021-2022). The participants were female students in the first year of secondary education.

The 1st tool was a measure of lateral thinking that included (30) items of the cognitive, skill, and emotional aspects. The 2nd was achievement test included (20) multiple-choice and true-false items that included the lessons of the third unit. The test was developed by researchers in collaboration with chemistry teachers

4. Discuss and interpret the results

The collected data were analyzed using the Statistical Program for the Social Sciences (SPSS) version 23.0.

As in table (1) the arithmetic mean for the experimental group was (29.01), while the control group was (17.6), and the calculated Mann-Whitney value (79.5) was smaller than tabulated, and the z-value was (4.15) larger than tabulated. These results indicate that there is a statistically significant difference at the level (0.05) in favor of the experimental group that was studied according to virtual trips, and thus the null hypothesis is rejected.

Table 1. The achievement scores of students

Groups	No.	Median	Rank Sum	Mann-Whitney U Value		Z-Score		Statistical Significance
				Cal.	Tab.	Cal.	Tab.	
Exp.	31	29.01	725.4	79.5	182	4.15	1.96	statistically significant
Students	34	17.6	582.6					

It was shown in table (2) that the arithmetic mean for the experimental group was (30.41), while the control group was (20.61), and the calculated Mann-Whitney value (108) was smaller than tabulated, and the z-value was (3.525) larger than tabulated. These results indicate that there is a statistically significant difference at the level (0.05) in favor of the experimental group that was studied according to virtual trips, and thus the null hypothesis is rejected.

Table 2. The lateral thinking scores

Groups	No.	Median	Rank Sum	Mann-Whitney U Value		Z-Score		Statistical Significance
				Cal.	Tab.	Cal.	Tab.	
Exp.	31	30.41	525.4	108	182	3.525	1.96	statistically significant
Students	34	20.61	582.6					

The results indicate that there is a significant difference between the proportion of the experimental group and the proportion of the control group, which can be directly attributed to the use of virtual field

trips. The comparison between pre- and post-VFTR measurements highlights this gain in statistical significance. The current study demonstrates the overall importance of virtual field trips for achievement in chemistry. With an increase in performance for the experimental group, compared to the control group, which means that virtual field trips can improve the level of understanding of the secondary stage. Chemistry, at least in theory, and promoting the achievement of what female secondary school students are expected to achieve in the chemistry subject of the first stage of the secondary level.

5. Conclusions

Virtual field trips have an impact in creating a state of integration between the home, the student, and the external environment, and moving the student from a state of inactivity to higher levels of creativity, which facilitates learning new phenomena. Using virtual field trips is an effective educational strategy to enhance cognitive learning skills. Virtual field trips are more effective in achieving chemistry among first-year middle school female students in Baghdad, Iraq than traditional trips and have a significant positive impact on lateral thinking skills. Traditional applications led to emotional exhaustion among first-year middle school students in the chemistry experiment, while virtual factories tried to teach them new information about the entertaining experiment. The use of interactive and attractive educational technology and enjoyable contexts is beneficial. This offers the possibility of replicating the study in introducing new chemistry-related curricular components into different educational institutions, such as incorporating similar educational settings into undergraduate programs.

Conducting further future research beyond the group of first-year intermediate female students to include other levels in schools and males. Those who have smart devices and are proficient with scientific instrumentation should also be included in the research to show the actual scope of VR around the actual field trip. Educators must integrate virtual field trips as an integrated part of the chemistry curriculum and educational practices for all seventh-grade female students in Baghdad in general and in the middle school in particular. By creating a unit that contains a few virtual field programs prepared for secondary school students in the form of an appendix found in electronic educational books, including video and narration. An intensive training program must be provided to teachers in the field of educational technologies to enable them to employ virtual field trips as an effective innovative strategy for teaching and learning chemistry and science in general.

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