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# Middle School Students' Learning of Social Studies in the Video and 360-Degree Videos Contexts

WAJEEH DAHER<sup>1,2</sup> AND HIBA SLEEM<sup>1</sup>

<sup>1</sup>Faculty of Educational Sciences, An-Najah National University, Nablus 9992200, Palestine

<sup>2</sup>Department of Mathematics Education, Al-Qasemi Academic College of Education, Baqa al-Gharbiyye 30100, Israel

Corresponding author: Wajeeh Daher (wajeehdaher@najah.edu)

**ABSTRACT** Video-based and 360-Degree Video-based learning is still not spread in the social studies classroom. The present research intends to study the influence of these tools on seventh grade students' level of knowledge in social studies. One hundred and five seventh grade students participated in the present research. Thirty-five students constituted each one of three classes: a regular class, a video-based class and a 360-Degree video-based class. Each class was assigned arbitrarily a specific teaching method: the regular method, the video method and the 360-Degree video-based method. The research results indicated that the regular group had significantly higher scores in the Applying knowledge level than the 360-Degree video-based group. It also indicated that the video group had significantly higher scores in the Analysis knowledge level than the control and the 360-Degree video groups. Moreover, the results indicated that the video and the 360-Degree video groups had significantly higher scores in the Synthesis knowledge level than the control group. The two technological tools did not contribute to the Evaluating level. More research is needed to verify the impact of video-based learning and 360-Degree video-based learning on students' knowledge levels; especially on higher-order thinking processes, in the different disciplines, but particularly in the social studies.

**INDEX TERMS** Knowledge levels, middle school students, social studies, video-based learning, 360-degree video learning.

## I. INTRODUCTION

Technology integration in social studies is a disputed issue. On one side, Shaver [1] expressed doubt that technology will ever provoke instructional reform in the social studies, but on the other side, Açıklan [2] says that "educators increasingly support the use of computer-supported instruction in social studies education" (p. 66). Tarman and Baytak [3] found that social-studies prospective teachers viewed technology both as a tool and as an instructional strategy. The previous couple of studies indicate that technology could become a tool for learning the social studies, where two such tools are the video and the 360-Degree video (360DV). The importance of these couple of tools is emphasized in emergency education as COVID19 Pandemic. Suryandari and Singgih [4] suggested video-based learning as a tool that could support teachers in

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their online learning during the COVID19 Pandemic. McIlvenny [5] suggested 360DV as a tool that enhances teaching and learning in COVID19 online learning.

Researchers in the social studies education consider video integration in students' learning as beneficial to this learning (e.g., [6]). This is also true for 360DV integration in the learning of the social studies (e.g., [7]). One aspect of this learning is the influence of Video-based learning and 360DV-based learning on students' knowledge, where one way to measure such knowledge is through Bloom six levels of knowledge: remembering, understanding, applying, analyzing, synthesizing and evaluating. The present research is interested in verifying the impact of video-based and 360DV-based learning on seventh grade students' knowledge-levels in social-studies. The research considers the learning of three social studies' classes, where one of them used 360DV to study the topic, the second used videos and the third utilized the regular social studies book. The present research intends to verify how the

three classes differ in the scores of six knowledge levels as they study the topic of holy places in Jerusalem.

#### **A. VISUALIZATION AND DYNAMICITY AS CONTRIBUTING TO STUDENTS' LEARNING**

The video learning, as well as the 360DV learning support visualization. Visualization helps engage students in higher-order thinking as creative and reflective thinking [8]. Gilbert [9] says that visualization is central to learning in general and learning science in particular. Visualization supports students in navigating within and between the modes of representation. Ismail *et al.* [10] found that the multimedia element of the video animation increased significantly imagination and visualization of students.

The dynamicity feature of software contributes to students' learning of the sciences. Isiksal and Askar [11] found that the dynamic software contributed significantly to the achievement of Seventh grade students in Geometry and to their self-efficacy for learning it. Granberg and Olsson [12] found that the dynamic software supported collaboration and creative reasoning by affording a shared working space and feedback, which supported the students in their creative reasoning. Christou *et al.* [13] argued that the dynamic software supports students' imagination in learning 3D geometry.

Ariffin *et al.* [14] argues that animation and graphic presentation help students improve their visualization skills. Animation and graphic presentations are part of the video and especially the 360DV environment, so it is expected that these environments assist students' learning, not only in the social studies but in all disciplines, and not only in the elementary school but in all school levels. Animation, graphic design and visualization would support lifelong learning. This is in line with Hurt *et al.* [15] who say that visualization which makes information and knowledge accessible to all could be part of all aspects of lifelong learning.

#### **B. VIDEO AND 360DV IN THE CLASSROOM**

Technology is suggested for the learning of social studies for it influences the different aspects of students' learning ([16], [17]). Specifically, it supports students' employment of visualization and dynamicity in their learning. One technological tool that could be integrated in the social studies classroom is the video. Video-based activities are being suggested to support electronic learning in general. Using videos can support students' learning and engagement, especially in social studies. Sherer and Shea [18] say that integrating videos in the design and delivery of lessons provides different opportunities for enhancing students' activity in the social studies classroom. Gaudence *et al.* [19] reported that the use of video in teaching motivated secondary students' learning of geography, enhancing their understanding and participation.

Another technological tool that could be utilized in the social studies classroom is the 360DV. Reyna [20] says that

in the 360DV context, the locations of viewers are fixed, and they are constricted to the object angles captured by the device. In 360DV, viewers can navigate right, left, up, down and zoom in and out of the video. Though some authors consider 360DV a type of virtual reality (VR) (ex., [7], [21], [22]), a dispute prevails whether 360DV is a virtual reality tool or not [20]. Snelson and Hsu [23] say that 360DV is often referred to as virtual reality as both provide immersion viewing experiences. Despite this identification, Snelson and Hsu [23] point at two differences between 360DV and VR. First, 360DV is generated with real-world footage while the VR is generated by using computer software. Second, 360DV allows left-right and top-bottom viewing within a spherical space limited by the filmmakers' views, while VR allows interaction with the objects in simulated digital worlds. The previous argument meets Black's [22] claim that 360-degree videos are different from traditional virtual reality because they are not interactive and limit the user's perspective to a point in the space. In the present research, we talk about 360DV learning, rather than virtual reality learning, to be more careful. Researchers point at 360DV as a powerful tool that supports and facilitates learning and teaching processes of the various disciplines [20]. This facilitation could result in 360DV making students' learning more immersive, which results in conceptual learning [23].

360DV has positive impact on the students' feeling of presence in the learning of social studies. Bowen [7] says that the 360DV properties provide a sense of presence for students, which would stimulate their sensation and attention to the learning objects. Moreover, they provide the student with a first-person perspective of authentic environments that address the learning topic. In addition, 360DV has positive impact on the affect aspect of students' learning of social studies. Zantua [24] reported that the 360DV, as a virtual reality tool, made Grade 6 students of the social studies more comfortable. A different learning aspect that 360DV could impact is the equity in the classroom. Kirksekiz *et al.* [25] say that 360DV would provide equal opportunities in education for students who do not have the opportunity to go to museums, which would offer a great contribution to their academic development.

Researchers described strong and weak impacts of 360DV-based learning on the different aspects of education in general. One such strong impact is the enabling of immersive learning [25]. Another one is its positive impact on the learning of declarative knowledge as facts and concepts [32]. In addition, it impacts positively the affective aspect of learning, as increasing learner's enjoyment [23] and subject-matter interest [32]. On the other hand, researchers described weak or negative impacts of 360DV-based learning on education. Panchuk *et al.* [33] reported that 360DV did not result in significant improvements in students' decision-making skills. In addition, Rupp *et al.* [30] argued that the act of being present in 360DV may require mental effort and attention

and thus impact negatively the learner's experience of 360DV. These pros and cons of 360DV point at the need for further research that investigates the potentialities of this tool for education. In the present research, we intend to verify the influence of video and 360DV on Seventh grade students' social-studies knowledge.

### C. BLOOM'S KNOWLEDGE TAXONOMY

Oosthuizen *et al.* [26] describe the Bloom's taxonomy as developed in 1956 by Bloom *et al.* and later revised in 2001 by Anderson *et al.* The categories in the first taxonomy included knowledge, comprehension, application, analysis, synthesis, and evaluation, which were later categorized as remember, understand, apply, analyze, evaluate, and create. Moreover, Bloom's taxonomy is a hierarchy, meaning that it moves from a lower level into a higher one.

Bloom's taxonomy has been used to assess knowledge levels of students and of questions in textbooks. Assaly and Smadi [27] evaluated the cognitive levels of the questions in a Master Class textbook. Using the original Bloom's taxonomy, they found that about 40% of the textbook's questions emphasized higher-order thinking skills. In addition, Koksall and Ulum [28] used the original Bloom's taxonomy to examine whether the exam questions of General English courses were based on both higher and lower order thinking levels. The examination revealed that the questions in the exam papers did not contain the higher levels in Bloom's Taxonomy.

The present research intends to use the original Bloom's taxonomy as an assessment tool that assesses the social-studies knowledge of seventh grade students. This use takes advantage of the taxonomy potentiality as a tool that supports the building of assessment tools and of activities according to different cognitive levels. This is in line with Crowe *et al.* [29] who built, based on the original taxonomy, an assessment tool to be used by biology faculty and students. The tool enabled the identification of the knowledge levels of learning activities with which students struggled the most, which helped adjust the teaching practices in accord. In addition, Prasad [30] described ways to use the original Bloom's taxonomy to assess students' critical thinking, which is related to their cognitive knowledge. The previous studies examined issues related to student's knowledge using the original Bloom's taxonomy, which shows its fit for the present research goals. This fit is stressed in light of our concern with levels of knowledge and not the processes of transition between the levels.

Video and 360DV enrich students' visualization and dynamic learning. These functionalities of the technological tools assist the students' cognitive learning, where one aspect of this learning is students' knowledge levels. The present research intends to further this issue by using the original Bloom's taxonomy to compose pre-test and post-test for seventh grade students in the social studies classroom.

### D. RESEARCH RATIONALE AND GOALS

Recently, educators have been investigating the use of 360DV in social studies [7], [24], [25]. This investigation is still in its infancy as Reyna [20] points out that few studies were conducted on using 360DV in learning, which indicates the need for such studies to determine its effectiveness in the classroom. If this is the situation, then it seems that studies are scarce on students' knowledge levels in social studies while engaging in video-based and 360DV-based learning. In addition, most current studies that address 360-degree video for education are conducted with university-level students [31], so there is a need to conduct such studies for school levels. The present study attempts to contribute to this field through studying seventh grade students' knowledge levels in social studies when using videos and 360DV.

The contribution of the present research is especially significant since 360DV in learning social studies is relatively new as described above, and thus research is needed to examine its impact on students' learning, where one main construct in this learning is the level of students' knowledge. The importance of this aspect lies in its influence on the different educational constructs as students' cognition and affect. The present research intends verify the impact of video-based learning and 360DV-based learning on students' knowledge levels. Specifically, it intends to answer the following three research questions.

### E. RESEARCH QUESTIONS

First question: Would the teaching method (regular, video and 360DV) result in significant differences in seventh grade students' answering of social studies questions that address specific knowledge levels?

Second question: Would the teaching method (regular, video and 360DV) result in significant differences in the knowledge level at which seventh grade students answer open social studies questions?

Third question: How do seventh grade social studies students perceive video-based/360DV-based learning as contributing to their study of a Social Studies topic?

The first research question targeted the correctness of students' answers on questions that each targeted a specific knowledge level. The second question wanted to evaluate the level of students' answers on open questions, where these answers could be at any knowledge level. The third question targeted students' perceptions of their learning the social sciences with different tools.

## II. METHODOLOGY

### A. RESEARCH CONTEXT, PROCEDURE AND PARTICIPANTS

The research was conducted in the academic year 2019-2020, in one male middle school that included four seventh grade classes. This school is in Nablus, Palestine and it includes students of middle socio-economic status. The students were

assigned to the classes by the school administration to guarantee that the classes were similar in terms of students' general achievement, i.e., according to the mean score of their grades in all the disciplines in the previous year. Three classes had thirty-five students each, while the fourth class consisted of thirty-six students. The same teacher taught the four classes. The three classes with thirty-five students participated in the research as they had insignificant differences in their knowledge level in the pre-test. Each class was assigned arbitrarily a specific teaching method: the regular method, the video method and the 360DV method. The students in the three classes were 12-13 years old. According to the social-studies teacher, the students in the three classes were generally medium to high achieving students in the social-studies discipline. The students, in the three research classes, learned the reported topic in ten lessons of 45 minutes. The lessons lasted for five weeks.

In the regular class, the teacher explained the learning material, showed examples on the solution of the questions, and gave the students similar questions to solve. The teacher in the Video and 360DV gave the activities to the students, and after they solved them, discussed the solutions with them. The lesson in the video and 360DV classes was divided into three parts: The students solve the activity individually, the whole class discusses the different solutions, and they arrive at conclusion regarding the topic of the lesson. Afterwards they solve similar problems. The students in the 360DV were encouraged to use the navigation in the 360DV and were enabled free navigation of this 360DV.

## B. LEARNING ACTIVITIES

The learning activities targeted the holy places in Jerusalem, though they involved, in part of the questions, other cities like Bethlehem and Nazareth. The activities in the regular classroom were taken from the seventh grade social studies book. This book was published in 2017 by the Palestinian ministry of education to combine between three subjects: Geography, history and Civic education. This book is the only book for social studies in the seventh grade in Palestine, as the ministry of education is the only author of school books in Palestine. The unit chosen for this study was the Islamic Civilization in Palestine, where this unit included the topic of the holy places in Palestine. We did not limit the unit only to the Islamic period in order to find relevant 360DVs. Thus, the Social Studies unit utilized in this study became 'Holy Places in Palestine'. The book activities were changed to fit the video and the 360DV environments. Below is the activity given to the students about 'The Church of the Holy Sepulcher', where the activities in the two versions included an image of the church. The students were engaged with other activities that targeted other holy places as the Al-Aqsa Mosque.

### *The Activity in the Regular Book:*

The Church of the Holy Sepulcher, which is also called the Church of the Resurrection or Church of the Anastasis, is in the City of Jerusalem. The church consists of a huge ancient building that includes the tomb, several churches,

chapels, and shrines. On the south side of the church there is a tiled courtyard whose remains reveal that it was like a wide colonnade. Its northern side is the facade of the church, and it meets this who comes to the church. A road is found in the south, with marble remains. On the right lies the Monastery of Abraham, the Armenian Chapel, and a church for the Copts called St. Michael's Church. In the west, there are the churches of Saint Jacob, Mary Magdalene and forty martyrs.

1. Describe the place of the church and its surrounding.
2. Read the textbook and describe what you concluded regarding the surrounding of the church. Why did you conclude that?
3. Describe what you concluded regarding the interior of the church. Why did you conclude that?

### *The Activity for the Video and the 360DV Classes:*

The Church of the Holy Sepulcher, which is also called the Church of the Resurrection or Church of the Anastasis, is in the City of Jerusalem. We want to watch the video/interact with the 360DV and answer the following questions:

1. Describe the place of the church and its surrounding.
2. Describe what you concluded from watching/walking around the surrounding of the church. Why did you conclude that?
3. Describe what you concluded from watching/walking inside the church. Why did you conclude that?

## C. VIDEO AND 360DV TOOLS

### *The Devices Used in the 360DV Class:*

The 360DV students utilized head mounted devices (HMD) to enhance the visual immersion in the holy places, in our case for Moslems, Christians and Jews in Jerusalem.

### *The Videos Used in the Video Classroom:*

The Video class used ten videos to study the Social Studies topic. These videos were related to the holy places in Jerusalem. Two of these were 'A Video Tour inside The Church of the Holy Sepulcher in Jerusalem' and 'Al-Aqsa Mosque from the Inside'.

### *The 360 Degrees Videos Used in the 360DV Classroom:*

The 360DV class used ten 360DV videos to study the social studies topic. These 360DV videos were related to the holy places in Jerusalem. Two of these 360DV videos were: '360 Video: Inside Church of the Holy Sepulcher, Jerusalem' and 'Inside al-Aqsa: A 360° Tour of Jerusalem's Holiest Mosque'. Links to all the videos used in the experiment are in Appendix 1. Experts were invited to evaluate the reliability of the two groups of videos as experimental materials. When they pointed at a problematic issue regarding one of the videos or 360DVs, we replaced it with another, consulting the experts again about its reliability.

## D. DATA COLLECTING TOOLS

### *Data Collecting for the First Question:*

We collected data using three tools. The first tool was a test that included six questions related to the six levels of knowledge according to Bloom. Table (1) includes the questions given in the post-test, where each question targeted

**TABLE 1. Knowledge types of questions in the post-test.**

Knowledge level	Question
Remembering	Which churches are in the nearby of the Sepulcher Church in Jerusalem?
Understanding	What are the differences between the Sepulcher Church in Jerusalem and the Church of the Nativity in Bethlehem?
Applying	Set the places of the Church of the Holy Sepulcher and Al-Aqsa Mosque on the map!
Analysis	Compare between Jerusalem as a holy place and at least another holy city.
Synthesis	Suggest how we can cultivate the holy places in Jerusalem.
Evaluating	What did you like and dislike in the holy places in Jerusalem?

a specific knowledge level. The same questions were given in the pre-test but on Al-Aqsa Mosque.

Each question had a maximum score of 10 and the student was assigned a score according to his proficiency in answering the question: 0 if the answer was totally wrong, 2.5 if the number of the wrong items in the answer were more than the number of the correct items, 5 if the number of the wrong items in the answer were the same as the number of the correct items, 7.5 if the number of the wrong items in the answer were less than the number of the correct items. The student was given 10 if he gave all the correct items required in the answer to the question and did not give wrong items.

*Data Collection for the Second Question:*

The second tool included the two following questions: Why are there many gates for Al- Aqsa Mosque? How are the holy places in Jerusalem cultivated by countries around the world?

The answer of each student was categorized according to one of the knowledge levels, and a contingency table was constructed to describe the data according to the knowledge levels and type of group.

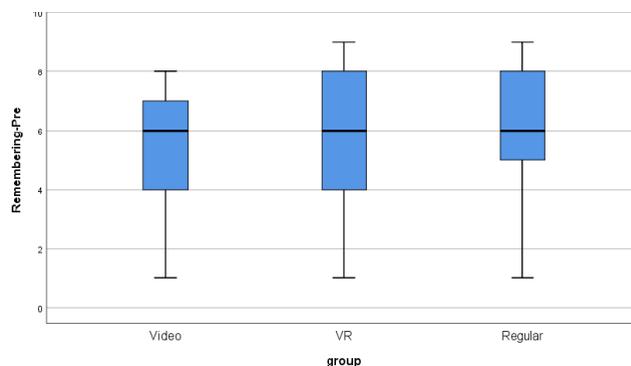
*Data Collection for the Third Question:*

The third tool was semi-structured interviews, where we asked the participants from the three research groups about their learning experiences. Three students from each class participated in the interviews. We got first the students' agreement, as well as their parents' agreement to participate in the interview. The two main questions asked were: what can you tell us regarding your learning about of the Church of the Holy Sepulcher topic? What helped you most in the learning of the topic? The previous two questions were asked again regarding the other holy places.

**E. DATA ANALYSIS TOOLS**

Data analysis tools for the first research question:

To test normality of the scores, Shapiro-Wilk test was used in the frame of answering the first question [34]. It showed



**FIGURE 1. The boxplots of the 'Remembering' scores before the experiment.**

**TABLE 2. Students' mean rank scores in the six levels of knowledge for the three groups before the experiment (N = 35 for each group).**

Group	R	V	360DV	$\chi^2$	p
Remembering	56.03	50.57	52.40	.597	.742
Understanding	57.21	50.71	51.07	1.296	.523
Applying	42.91	62.19	53.90	1.331	.514
Analyzing	49.63	56.63	52.74	.729	.694
Synthesizing	53.73	57.20	48.07	1.789	.409
Evaluating	54.16	55.79	49.06	1.092	.579

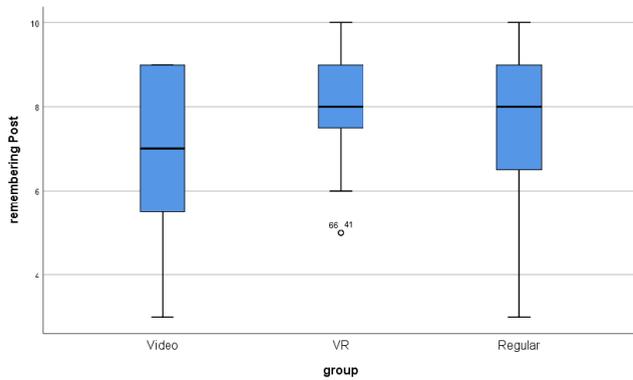
R=Regular, V=Video, 360DV =360 degrees video

that the scores of the three groups in the six levels of knowledge before the experiment were not normal as the significance of this test values were less than 0.05 [35]. This made the Kruskal-Wallis test candidate for examining whether the differences between the scores of the three research groups in the six levels of knowledge were significant [35].

The samples were taken independently of each other and the groups had approximately the same shapes since the boxplots were all about the same shape [36] (Fig. 1 shows an example of the boxplots of the 'Remembering' scores).

The previous results showed that the scores of the three groups in the six types of knowledge before the experiment were appropriate for carrying out the Kruskal-Wallis test [36]. This test showed that there was not a significant difference in the scores of any of the six knowledge levels between the different groups. Table 2 shows the results of this test.

The normality of the scores was also examined for the after- experiment data. Shapiro-Wilk test of normality showed that the scores of the three groups in the six levels of knowledge after the experiment were also not normal as the significance of this test values were less than 0.05. Thus, based on the results that the post-test scores were not normal, Kruskal-Wallis test was again a candidate test for examining the significance of the difference between the three research groups after the experiment [36]. Examining its assumptions, it turned out that these assumptions are satisfied as the observations were independent in the three groups and the groups had approximately the same shapes since the boxplots were all about the same shape. Fig. 2 shows the boxplots for the Remembering scores after the experiment.



**FIGURE 2.** The boxplots of the 'Remembering' scores after the experiment.

We carried out the Kruskal-Wallis test, as its assumptions were satisfied, to answer the first question [36].

In examining whether the differences were significant between the scores of the students in the three classes in the six levels of knowledge, before and after the experiment, we considered the .05 level acceptable for such examination [37], but we also reported the significance below .05 as below .01 and below .001. We did that following many researchers (ex., [38])

*Data Analysis Tools for the Second Research Question:*

To answer the second question, we analyzed students' answers to one of two open questions to avoid repetition. We used chi square analysis. Chi square was fit since less than 20% of the cells had expected frequency less than five, and no cell had an expected frequency less than one. Post-hoc analysis was performed to examine which cells contributed to the significance of the correlation of independence between the group and the knowledge level of the students' answers (the two dimensions of the contingency table). The post-hoc analysis was done using adjusted residuals [37]. IBM [38] says that such post hoc analysis needs to do Bonferroni-adjusted significance tests for pairwise comparisons. It suggests doing this post hoc analysis by performing Bonferroni adjustment that can be done through dividing first the desired alpha-level by the number of comparisons. Second, to use the calculated number as the p-value for determining significance.

*Data Analysis Tools for the Third Research Question:*

To answer the third question, inductive content analysis was performed [39]. This was done following other qualitative studies that looked for themes and grouped them into categories that represented the studied phenomenon (e.g., [40]).

**III. RESULTS AND DISCUSSION**

**A. THE FIRST RESEARCH QUESTION: THE DIFFERENCE BETWEEN THE RANK SCORES OF STUDENTS' KNOWLEDGE IN EACH LEVEL**

The first research question verified whether the teaching method (regular, video and 360DV) affected the level of Seven Grade students' knowledge in social studies topics. The Kruskal-Wallis test was performed to examine whether

**TABLE 3.** Students' mean rank scores in the six levels of knowledge in the three groups after the experiment.

Group	R (N=35)	V (N=3)	360DV (N=3)	r	$\eta^2$
Mean rank		5)	5)		
Remembering	52.96	46.80	59.24	3.10	.030
Understanding	48.36	59.06	51.59	2.60	.025
Applying	64.27	51.14	43.59	8.98*	.086
Analyzing	35.60	73.34	50.06	28.33***	.272
Synthesizing	33.79	54.49	70.73	27.96***	.269
Evaluating	46.83	53.90	58.27	3.358	.032

R=Regular, V=Video, 360DV=360 degrees video

\* p<0.05, \*\*p<0.01, p<0.001

**TABLE 4.** Test statistic for the significant pairwise comparisons.

Knowledge level	Group	V	360DV
Applying	R	-13.129	-20.686**
	V	---	7.557
Analysis	R	37.743***	14.457
	V	---	23.286**
Synthesis	R	20.700*	36.943**
	V	---	-16.243

R=Regular, V=Video, 360DV=360 degrees video

\* p<0.05, \*\*p<0.01, p<0.001

the differences were significant between the scores of the students in the three classes in the six levels of knowledge, after the experiment. Table 3 shows the results of this test.

Table 3 shows that the three groups did not differ significantly after the experiment in Remembering, Understanding, and Evaluating, but differed significantly in Applying, Analyzing and Synthesizing. These results indicate that the teaching method impacted less the two 'lower levels' of knowledge; i.e. Remembering and Understanding, as well as the highest one; i.e. evaluating. The teaching method impacted more the three other knowledge levels: Applying, Analyzing and Synthesizing. This impact, as eta squared shows, was small in the case of applying, while it was medium in the case of analysis and synthesis. A post-hoc test, using Mann-Whitney test with Bonferroni correction, was run to find the significant differences in Applying, Analysis and Synthesis between the different pairs of the research groups. Table 4 shows the results of the computation.

The significant higher rank score of the Regular group in Applying could be explained by the direct instruction in the regular group, where the teachers presented to the students the solution method of the social studies problem. This presentation guided the students step-by-step in the solution process, which made it easier for them to apply the solution process in order to solve related problems, even when the problem differed somehow from the problem for which the teacher showed the solution.

The significant higher rank score of the Video group in Analysis could mean that the Video teaching was more

**TABLE 5. Examples on students’ answers according to the knowledge level.**

Knowledge level	Question
Remembering	The existence of a great wall surrounding the mosque makes it necessary to have many gates to facilitate the entrance of worshippers.
Understanding	To lessen crowding at time of prayers and religious events
Applying	To enable men and women to reach the mosque through different gates.
Analysis	To shorten the distance for worshippers and visitors to enter from any direction of the city
Synthesis	To enable warriors to enter the mosque to liberate it from invaders.
Evaluating	There were various reasons for the many gates. One of these reasons was to defend the mosques from enemies, while another was to make the mosque accessible for worshippers.

effective in contributing to the analysis level of the social Studies students than the other two teaching methods. Different studies have shown that video can be a highly effective educational tool (e.g., [41], [42]). Guo *et al.* [43] consider watching a video to initiate reflection or discussion as a stimulus activity in Geography education. It seems that this stimulus could impact positively students’ analysis processes in social studies.

The significant higher rank score of the 360DV group in Synthesis indicates the contribution of technology in general to higher order thinking skills [44]. In particular, it indicates the contribution of videos and 360DV to the learning of social studies [7].

**B. THE SECOND RESEARCH QUESTION: THE LEVEL OF STUDENTS’ ANSWERS TO AN OPEN QUESTION**

The second research question verified how students from the three research groups differed regarding the level of their answers to open social studies questions about the holy places in Jerusalem. We present here the analysis of the levels of students’ answers to the open question: Why are there many gates for Al- Aqsa Mosque? Students’ answers to the question expressed differences between the groups like those appearing in the results of the first research question. Table (5) includes an example of students’ answer at each level.

Table 6 shows the frequencies of the knowledge levels of students’ answers on the question.

To find whether the knowledge level of students’ answers differs significantly among the three groups, a chi-square test of independence was performed, which gave the relationship between the variable ‘group’ (Regular, Video, 360DV) and the variable ‘Level of knowledge’ (Remembering, Understanding, Applying, Analysis, Synthesis, Evaluation). The previous relationship was statistically significant,  $\chi^2(10, N = 196) = 61.019, p < .001$ . To perform post hoc analysis, the Bonferroni-corrected critical p-value was computed to be

**TABLE 6. Frequencies, adjusted residuals and p values of the knowledge levels of students’ answers.**

Knowledge level		R	V	360 DV
Remembering	Count	25	6	6
	% within question	67.57%	16.22%	16.22%
	Adjusted Residual	6.28	-2.37	-3.38
	p	.0000	.0178	.0007
Understanding	Count	10	26	16
	% within question	19.23%	50.00%	30.77%
	Adjusted Residual	-1.39	3.11	-1.72
	p	.1645	.0019	.0854
Applying	Count	6	11	7
	% within question	25.00%	45.83%	29.17%
	Adjusted Residual	-.18	1.47	-1.24
	p	.8572	.1416	.2150
Analyzing	Count	5	11	27
	% within question	11.63%	25.58%	62.79%
	Adjusted Residual	-2.51	-1.12	3.32
	p	.0121	.2627	.0009
Synthesizing	Count	2	5	18
	% within question	8.00%	20.00%	72.00%
	Adjusted Residual	-2.25	-1.44	3.40
	p	.0245	.1499	.0007
Evaluating	Count	4	5	6
	% within question	26.67%	33.33%	40.00%
	Adjusted Residual	.01	.06	-.07
	p	.9920	.9522	.9442

R=Regular, V=Video, 360DV=360 degrees video

0.05/18 = .0028, where 0.05 is the original significance value, while 18 is the number of comparisons presented in Table 6.

We compared the p-value of the adjusted residual in each cell with the critical p-value, which indicated that what contributed to the significance of chi-square correlation of independence is the frequency of Remembering in the Regular group (67.57% of those who answered the question at the Remembering level) and in the 360DV group (16.22% of those who answered the question at the Remembering level). Understanding in the Video group also contributed to the significance of the correlation of independence (50% of those who answered the question at the Understanding level). Synthesis in the 360DV group contributed to the significance of the chi correlations of independence (72.00% of those who answered the question at the Synthesis level). The previous results indicate that not only 360DV contributed to motivating higher-order thinking skills but the Video-based learning too. The two technological means depend on visual means, which are suggested to promote high order thinking [45].

### C. THE THIRD RESEARCH QUESTION: STUDENTS' PERCEPTIONS OF THEIR LEARNING IN THE THREE CONTEXTS

Categorizing the interviews of students from the three research groups showed three categories related to their perceptions of the tools' function: the tools' visualization, control over the learning process and dynamicity of the learning tool.

#### 1) TOOLS' VISUALIZATION

Responses of the students in the video-group showed that the visualization enabled by the video-learning influenced the students' knowledge of the holy places. One student from the Video group said: "I could see the Chambers of the Three Marys near the Armenian House, the Coptic Church behind the Holy Tomb and the Statue of Our Lady. The decorations, paintings and pictures on the walls attracted my attention. I could spend a long time in considering the details of these decorations, paintings, and pictures. This consideration enabled me to analyse and make comparisons between the artistic feature of the different places".

#### 2) CONTROL OVER THE LEARNING PROCESS

A Video-learning student said: "I could stop the video when seeing something important in order to contemplate and analyse the properties of the images". The student's statement shows the importance that students put on their ability to control their learning during their work with videos, which would increase their positive perceptions of this learning [46] and as a result their engagement in their learning [47].

#### 3) DYNAMICITY OF THE LEARNING TOOL

Responses of the 360DV-group students showed that the visualization and dynamicity provided by the 360DV learning contributed to students' knowledge of the holy places. One student from the 360DV group said: "I could wander to the vast chambers of the church, get very near to the beautiful lights hung in the ceiling, I felt as if I was a tourist visiting the place, as if I could touch the Holy Tomb". Another 360DV student said: "Being able to go to any tiny place that you find interesting helped me see the similarities between the various parts of the holy place, which helped me build generalizations about this holy place, as the architecture of the place". This facilitation of generalization by the 360DV technology could be related to its visualization enabling [48]

The above results from the interviews support the quantitative results that the video-learning assisted the students to perform Analysis processes, while the 360DV-learning assisted the students to perform Synthesis processes and build generalizations related to holy places.

### IV. CONCLUSION: IMPACT AND LIMITATIONS

The present research intended to verify the impact of Video-based learning and 360DV learning on the knowledge level of seventh grade students in social studies. The importance

of the research is especially emphasized as these couple of tools could be applied as effective tools in emergency education as COVID10 Pandemic. The results of the research, whether through considering the rank scores of the answers, the level of the answers or the participants' perception of the video-based and 360DV-based learning, indicated that both Video-based learning and 360DV-based learning impacted positively the levels of knowledge in social studies. These results contribute to research about video-based and 360DV-based learning. It strengthens past research that indicated the positive impact of video-based and 360DV-based activities on students' learning of the different disciplines (e.g., [19], [20]). It also make these tools candidate for rich use by teachers, especially in online education, whether in times of emergency as the present COVID19 pandemic or in regular times.

The visual aspect of both technological tools supported the students' visualization and thus imagination processes, what contributed to their high order thinking processes. This is expected to be the case, not only for social studies, but for other disciplines and other school levels. Developing students' visualization and imagination processes prepares the students for lifelong learning needed in the digital age, the age of continuous changes. This role of visualization is in line with previous studies that indicated the contribution of visualization to students' learning [49]. In addition, the dynamic aspect of 360DV supported the students who used it in their synthesis processes, which supports the claim that the dynamic feature of technological tools supports students' substantial learning [50]–[52]. It is understandable that the three teaching methods did not differ significantly in the Remembering and Understanding levels, where it is the main goal of teaching in general to contribute to students' understanding of the subject matter. Thus, the teaching methods take also care of the Remembering processes that enable understanding through the connection aspect [53].

One impact of the present research is that it shows some main functions of the video and 60DV in students' learning: visualization, dynamicity, and self-control. This finding would assist educators to build activities that take advantage of these three functions. A second impact of the present research is that it shows the influence of different teaching methods on students' learning of social sciences. This calls to use different teaching methods and tools in the classroom as they impact different knowledge levels. It is interesting that the two technological tools did not contribute to the Evaluating process. Thus, another impact of the present research is that it opens the way for future research that studies how the Video and 360DV, as teaching method, could influence students' evaluation processes.

One limitation of the present research is that it was conducted in the social studies classroom. In general, more research is needed to verify the impact of Video-based learning and 360DV learning on students' levels of knowledge in the different disciplines. A second limitation of the present

research is that it was conducted in a male school. Similar research is needed in female and mixed schools.

The present research showed the impact of video-based and 360DV based learning on the knowledge level of seventh grade students. This grade also limits the present research, where more research is needed to study the impact of video-based and 360DV based learning on the different aspects of students' learning. This research is especially needed for the elementary school levels, particularly in the lower grades.

Minocha, Tudor and Tilling [54] found that Google Expeditions provide 360-degree visual authenticity and allow inquiry learning. More research is needed to investigate the use of Google Expeditions for watching 360DV in social studies, especially its impact on students' knowledge levels.

## APPENDIX 1 LINKS TO THE VIDEOS AND 360DVs

Place	Video link	360DV link
Virtual tour of holy Jerusalem	<a href="https://www.youtube.com/watch?v=QyvavfI_GyLs&amp;t=188s">https://www.youtube.com/watch?v=QyvavfI_GyLs&amp;t=188s</a>	<a href="https://www.youtube.com/watch?v=Ax8NA-V5x34&amp;t=126s">https://www.youtube.com/watch?v=Ax8NA-V5x34&amp;t=126s</a>
Inside the Sepulchre Church	<a href="https://www.youtube.com/watch?v=QyvavfI_GyLs&amp;t=74s">https://www.youtube.com/watch?v=QyvavfI_GyLs&amp;t=74s</a>	<a href="https://www.youtube.com/watch?v=IDTWQ1UnCqM">https://www.youtube.com/watch?v=IDTWQ1UnCqM</a>
Tomb of Jesus	<a href="https://www.youtube.com/watch?v=kagLdjf26FY">https://www.youtube.com/watch?v=kagLdjf26FY</a>	<a href="https://www.youtube.com/watch?v=mEs_ajjPZnQ">https://www.youtube.com/watch?v=mEs_ajjPZnQ</a>
Renovation of the Tomb of Jesus	<a href="https://www.youtube.com/watch?v=8gjwrPX2DZM">https://www.youtube.com/watch?v=8gjwrPX2DZM</a>	<a href="https://www.youtube.com/watch?v=lf8rAvVCU24">https://www.youtube.com/watch?v=lf8rAvVCU24</a>
The Surrounding of Al-Aqsa Mosque	<a href="https://www.youtube.com/watch?v=epOkXJp0vrM">https://www.youtube.com/watch?v=epOkXJp0vrM</a>	<a href="https://www.youtube.com/watch?v=gOQAJaffIMk">https://www.youtube.com/watch?v=gOQAJaffIMk</a>
Inside Al-Aqsa Mosque	<a href="https://www.youtube.com/watch?v=BGwAVxTtOWY">https://www.youtube.com/watch?v=BGwAVxTtOWY</a>	<a href="https://www.youtube.com/watch?v=O12LG07Nl6c&amp;t=120s">https://www.youtube.com/watch?v=O12LG07Nl6c&amp;t=120s</a>
The Dome of the Rock	<a href="https://www.youtube.com/watch?v=ORpX_ivQX7A">https://www.youtube.com/watch?v=ORpX_ivQX7A</a>	<a href="https://www.youtube.com/watch?v=ILvgqx2yfkQ">https://www.youtube.com/watch?v=ILvgqx2yfkQ</a>
Western Wall	<a href="https://www.youtube.com/watch?v=l7HHTklwK2l">https://www.youtube.com/watch?v=l7HHTklwK2l</a>	<a href="https://www.youtube.com/watch?v=mR9rTrMHNZ4">https://www.youtube.com/watch?v=mR9rTrMHNZ4</a>
King David tomb	<a href="https://www.youtube.com/watch?v=tv0QFNdMvd0">https://www.youtube.com/watch?v=tv0QFNdMvd0</a>	
Mount of Olives	<a href="https://www.youtube.com/watch?v=6W1xnfi mPdc&amp;t=201s">https://www.youtube.com/watch?v=6W1xnfi mPdc&amp;t=201s</a>	<a href="https://www.youtube.com/watch?v=e_S0GMNtuyY">https://www.youtube.com/watch?v=e_S0GMNtuyY</a>

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**WAJEEH DAHER** is a Professor Doctor with the Department of Educational Sciences, An-Najah National University and the Head of the MTeach Program with the Al-Qasemi Academic College of Education. He has authored and coauthored numerous articles in the field of mathematics education and the field of technology in education. His articles address the different aspects of students' learning and pre-service teachers' education.



**HIBA SLEEM** is an Assistant Professor with the Department of Educational Sciences, An-Najah National University. She has authored and coauthored articles in the different aspects of social studies education. Her research interest includes educational research in social studies.

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