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Research Article

The use of interdisciplinary approach in geometry teaching: The example of Arab-Islamic civilization

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Abstract

This paper presents the important topic of using photographic images connected with tradition and art as enrichment items in geometry classes, on subjects relevant in the context of Arab-Islamic civilization. In addition, the study presents the use of photographic images (photographs) of mathematical objects in lessons on geometric thought, as a means of increasing students' involvement and enhancing their learning experience. Examples of photographs taken from Arab-Islamic civilization are presented, suggested for being especially appropriate for teaching geometry to Arab students at an Arab teacher training college. The study involved 50 participants: Twenty-four teachers in the academic retraining program, to become mathematics and computer sciences teachers; 26 regular students in their fourth year, majoring in mathematics and computer sciences The teachers and students participated in the compulsory course: Arab-Islamic Civilization at an Arab teachers training college. This group was chosen since they are designated to become math teachers and serve as agents of change in schools. In this study we used a questionnaire with one version for both groups of participants – teachers in retraining and regular students in their fourth year of study in the teaching of mathematics and computer sciences. The first two question are intended to provide initial personal information (profession, and math teaching experience) and the Questions 3-13 are open questions providing information with regard to teachers' and students' positions on the study topic. At the end of the questionnaire, the participants were asked to make additional comments. The paper include a model of a mathematics lesson including a mathematical photograph connected with Arab-Islamic civilization and Examples of pictures and an example of a lesson plan designed in accordance with the proposed model. The analysis of the findings connected with the questions that appeared in the opinion questionnaire, and divided in to seven categories. The findings of this study indicate positive attitudes of teachers and students towards integration of teaching methods including the use of photographic images in teaching in general and geometry in particular. The study discussed in this paper may contribute to teachers' and teacher cadets' professional development in making geometry classes in the mathematics discipline more experiential, and thus reducing anxiety and fear of mathematics.

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Introduction

In this day and age of advanced technology, we are witness to significant change—as in the training of teachers and teacher cadets in the colleges, expressed in integration of a variety of innovative methods and ways of teaching, as well as new technological tools—as an integral part of realizing significant, experiential learning in the framework of the *Ofek*

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Hadash ("New Horizon") and *Oz LeTmura* ("Courage to Change") educational reforms. As opposed to these, we are also witness to revulsion from the traditional frontal method.

A great deal of research literature exists on the anchoring of mathematics instruction in students' cultural contexts (Katzaf, 2004, 2006; Mussarwa, 2012; Daher, 2004). Many philosophers touched on the importance of photographic images and integration of pictures in the teaching of various academic disciplines. The most ancient and commonly used saying: "A picture is worth a thousand words" is attributed to the famous Chinese philosopher Confucius. Philosopher Régis Debray offered his perspective too, in an attempt to define a picture: "A picture contains five billion meanings and translations, as the number of living things in the universe". As opposed to them, Barnes (2014) noted that Aristotle did not describe what a picture is in his opinion, but rather saw the practical aspect of using them, saying that "thinking is not possible without the use of pictures in teaching".

Williams (1963) in his book *Learning from Pictures* noted 31 reasons to learn with pictures, the main ones being: Developing engagement between teacher and student and among the students themselves, structuring knowledge, and assisting in understanding the subject material. As opposed to Williams, Roland Barth (1980), from the definitive aspect, claimed in his book *Thoughts on Photography* that photography derives from the source of theater, with the photographer conducting a kind of play for the spectators – to amaze them, arouse their interest, and shock them. Contrary to the previous claim, several years later, Barth (2002) noted in his article that in his view, photography provides us with reality itself.

This paper deals with the important topic of using photographic images connected with tradition and art as enrichment items in geometry classes, on subjects relevant in the context of Arab-Islamic civilization. In addition, the study suggests the use of photographic images (photographs) of mathematical objects in mathematics lessons as a means of improving students' engagement and learning. When teaching mathematics, we are interested in showing its presence in various aspects of life, and its presence in cultural treasures may be relevant from both the mathematical and cultural aspects. Examples of photographs taken from Arab-Islamic civilization are presented, suggested for being especially appropriate for teaching mathematics to Arab students.

The photography picture taken with a camera is considered a source of knowledge, providing information from daily life (Ismaili and Awatef, 2011). Learning with pictures can spur development of engagement between teacher and student and among the students themselves and assist in structuring knowledge and understanding the subject material. The use of photography in a cultural context is considered an effective means of teaching mathematics in general, and geometry in particular. Practicing teachers and teaching cadets constitute a relevant group for training and guidance in integrating innovative and challenging means of teaching mathematics to achieve significant learning. Both groups see the importance of having an elaborate toolbox to assist them in delivering mathematical content to students in an interesting and experiential way, mainly in teaching geometry. In the mathematics textbooks and curricula there is no mention of integrating pictures or photographs in the teaching of math in general and geometry in particular. Williams (1963) in his book *Learning from Pictures* notes thirty-one reasons to teach with pictures, the main ones being: Developing engagement between teacher and student and among the students themselves and structuring knowledge assist in understanding the subject material. As opposed to Williams, Barth (1980), in his book *Thoughts on Photography*, claims that photography derives from the source of theater, with the photographer conducting a kind of play for the spectators – to amaze them, arouse their interest, and shock them. In addition, in his second book: *The Photographic Message*, Barth (2002) notes that in his view photography provides us with reality itself.

Geometry is a central area in the study of mathematics (Lester, 2007). From a young age, children encounter geometrical shapes (Ministry of Education, 2006). In addition, geometry is considered by students to be one of the most difficult areas of mathematics (Hofer, 1981).

Studies focused on identifying students' difficulties in geometry indicate the need to raise teachers' awareness of them and delve deeper into students' understanding in order to preclude problematic situations (Gal, 2011). One way of dealing with these difficulties is contextual learning (Verner & Maor, 2005). Context problems are defined as problems dealing in situations close to the student's world and culture (Gravemeijer & Doorman, 1999). Researchers in

mathematical education recommend connecting the teaching of mathematics to the student's culture (Orey & Rosa, 2007). This can be achieved through an ethnomathematical approach, i.e., teaching mathematics within a cultural and ethnic context, integrating mathematical problems associated with different civilizations or the student's culture, thus making the subject of mathematics more interesting and the mathematical content easier to learn.

Katzaf (2006) notes in her articles that teachers who experienced the integration of ethnomatematics in mathematics lessons became convinced that recognizing mathematics as part of civilization nurtures a positive attitude towards mathematics and constitutes a bridge between the mathematics class and the outside world. In addition, Katzaf (2004) stresses in her article the significance and contribution of humanistic mathematics. Similarly, Mussarwa (2012) noted in her study that the students who participated in the study reported that their experience in studying and teaching geometry in a cultural context increased their awareness of the importance of cultural aspects in teaching geometry.

Edri and Movshovitz-Hadar (2014) noted in their study that education for personal and social values may be integrated in teaching mathematics, without compromising students' achievement and teaching of the curriculum. This requires preparation of suitable teaching materials and training teachers and teaching cadets in using them.

Daher (2004) relates to several advantages of integrating the history of Islamic civilization in teaching mathematics. Giving the mathematics subject meaning reduces students' anxiety over learning mathematics, spurs and encourages them in solving challenging mathematical problems, and strengthens their connection and affinity to figures that have greatly contributed to advancing the teaching of mathematics by developing various methods and ways of solution. In addition, Daher notes in his article that one of the factors encouraging integration of photographic images in teaching mathematics in general and geometry in particular is teachers' lack of knowledge in delivering lessons and building study units. In addition, the textbooks and curricula do not relate to integration of this tool in teaching mathematics.

To the best of our knowledge, no studies addressing the use of photographic images in teaching geometry at schools have been done yet.

The present study discusses the importance of the use of photographs or pictures as a tool in teaching geometry in a cultural context in general, and in the context of Arab-Islamic civilization in particular. The paper will present the stages of development of geometry lessons integrating the use of photographic images and relate to participants' responses. In addition, an example of a lesson and two additional pictures from Islamic civilization suitable for a geometry lesson.
The paper includes the following components: A. The model of a mathematics lesson including a mathematical photograph connected with Arab-Islamic civilization. B. Examples of pictures and an example of a lesson plan designed in accordance with the proposed model: integrating mathematical pictures and photographs on topics such as the "the box", "shapes on planes and in space", geometrical forms and symmetry". Activity in the lessons integrates learning the definition of the concepts "the box", "shapes on planes and in space", geometrical forms and symmetry".

It should be noted that all lesson plans include full integration of questions relating to historic, cultural, and religious content, and questions relating to mathematical content.

The Kaaba

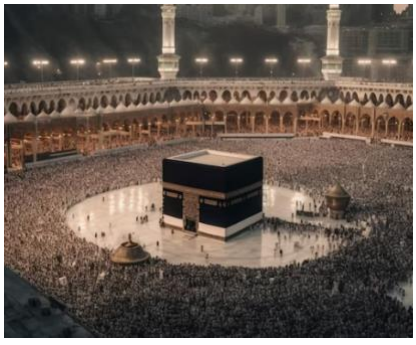

Photo 1. The Kaaba

Target audience: sixth grade classes

Lesson objectives:

- Create an encounter with geometry by presenting pictures from Arab-Islamic civilization.

- Become familiar with the holiest and most important site of worship in Arab-Islamic religion and civilization.
- Learning the concept "box" through a photographic image associated with Islamic structures.
- Experience in calculating the volume and surface of the box.

Opening the lesson

Class discussion on the question: What is a body in general, what is a "box" in particular, and how the teacher, and how does the teacher connect the subject of the lesson to historical, religious, and cultural content.

The teacher directs the students to search for knowledge in databases, such as the description of a box or cube, or concepts associated with the box structure such as sides, corners, vertices, and diagonals, as well as the properties of the box, calculation of the area of a rectangle, square, and volume of a box.

First possible question, in pairs: Students, try and have a discussion on geometry studies. In this case, "a box", as part of Arab-Islamic history.

Another possible question: Students, try to imagine the period and life of Arab-Muslims in this era. What, in your opinion, were the uses of mathematical knowledge?

Lesson structure

Learning in the lesson can be done in several ways:

A. Self-study – each student receives a page of questions for self-study, relating to finding relevant information on the lesson topic.

B. Work in pairs – each pair will try to work together in solving the questions raised in class.

C. Class discussion – the teacher conducts a symposium with the whole class participating, and everything said in the discussion is written on the board.

The choice of the way of study depends on the composition of the class and lesson objectives set by the teacher.

Description of the activity

After an opening discussion, the students should be told that the topic of the lesson is "the box". The students shall work in four different groups, and attempt to solve the questions proposed in two stages:

Stage one: The first two groups will receive questions relating to the historical-religious content, and the other two groups will receive questions relating to the mathematical content.

Stage two: The first two groups will switch with the other two in solving the mathematical questions. The other two groups will attempt to solve the questions relating to the historical-religious content.

It should be noted that after solving the questions, the two groups will write the answers on Bristol boards for presentation, discussion, and summary of the lesson.

The questions presented and proposed to the students in connection with the picture:

Questions relating to the historical-religious content:

- Why is the Kaaba considered the holiest and most important building in the world for Muslims?
- Where in the Kaaba located?
- According to the Koran and Islamic tradition, who built the Kaaba?

Describe the Kaaba structure.

- How is the Haj (pilgrimage) precept connected with the Kaaba?

Questions relating to the mathematical content:

Search the sources and note what the body of the Kaaba is.

Describe the body you have noted in question A.

According to the body you noted in Question A, answer the following questions:

- How many sides does the body have?
- How many vertices does the body have?
- What are the body's sides? Squares, rectangles, triangles, etc.?
- How many diagonals does the body have?
- How many edges does the body have?

- What types of polygons are obtained by spreading the body?

What is required in order to calculate the volume of the body?

Search the sources to find the real dimensions of the Kaaba and calculate its volume accordingly.

Those responsible for the Kaaba structure decided to renew its exterior paint coating (without the roof). Each square meter (m^2) requires 15 liters of paint, and the cost of each liter is 90 Saudi riyals.

Calculate how many liters of paint are required to paint the external walls.

Calculate the total costs of painting the exterior walls of the Kaaba.

Summary of the lesson

In the concluding discussion, each group shall choose a representative on its behalf to hang the Bristol board it prepared for conclusion and general discussion in class. It is recommended to ask the students whether they enjoyed the lesson, and have each student tell about something new he learned from the lesson.

Testimonies and opinions of teachers and students exposed to the practice

Pictures proposed for preparing the lesson plan in geometry

Photo 2. Some examples for lesson

A model of the development stages including pictures or photographs

Choosing the picture

At this stage, the teachers choose a picture with a cultural context, with which they can construct an interesting and enjoyable geometry lesson in line with the curriculum that will lead to an understanding of geometric content.

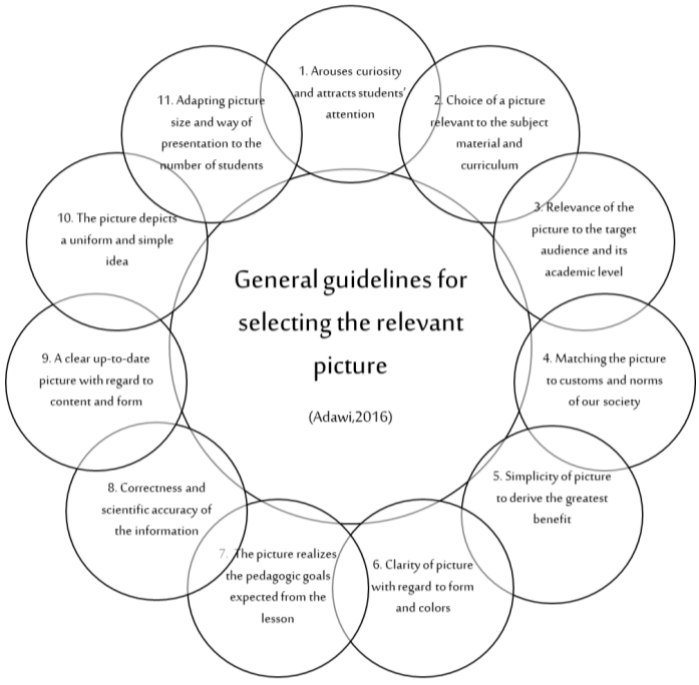

Illustration 1: General guidelines for choosing a picture

This diagram includes general guidelines that direct teachers and teaching cadets in choosing a relevant picture and integrating it in geometry teaching.

- Brief information on the picture: A short explanation on the picture, both content and form.
- Link between the picture and the syllabus/curriculum: Relevance of the picture to the course syllabus and curriculum, mainly in geometry.
- Expectations: Teacher's expectations – does the picture chosen for the lesson arouse the students' emotions and desire to learn (emotion and morality/ethics).
- Way of presentation: Whether to present the picture before or after learning the topic.
- Students' reactions: Give the students the opportunity to comment after allocating the lesson's activity, reading the questions, and presenting the picture.
- Opening questions to arouse curiosity and for illustration: After presenting the picture, the teacher presents the opening activity for curiosity and brainstorming, such as a quiz, a puzzle, questions, a map of concepts, etc.

The planning and building stage of the lesson

"First steps": As a first step, the students should be given a brief explanation of the subject and its goals. In addition, the teacher should arouse students' motivation by presenting guiding questions, associations, a quiz, or an educational puzzle. The teacher should also explain the stages of the lesson's structure, and how learning will be conducted (self-study, work in groups, class discussion).

Performing the lesson in class

The class structure is as follows:

- After the lesson is started, the students may be divided into work groups according to the class composition.
- Allocation of tasks among the various groups for experience.
- The students shall solve the task questions.
- The teacher will go from one group to another to verify group activity and performance of the tasks.
- A summary of the answers to the questions shall be drawn on a Bristol board by the various groups.
- A representative from each group shall hang the Bristol on the board for presentation purposes and a general class discussion.
- The students shall tell of their experience in solving the tasks and anything new they learned from the lesson.

Reflection stage

After the execution stage, teachers and students were asked to reflect on the process they went through. They are asked to discuss the process of finding the picture or photograph relevant to the lesson, the target audience, and the curriculum and then connect the depicted information with the subject matter and share impressions such as difficulty of execution, contribution, efficiency and effectiveness, interest, and enjoyment.

The teachers and students performed and submitted the preliminary stage, the execution stage, and the reflection stage. In addition, some of the participants gave a presentation on building a though-provoking lesson according to the stages and guidelines required for assessment for learning (AFL).

Aim of the Study

This study examines the positions and outlooks of teachers in retraining and fourth year students majoring in mathematics and the computer sciences in one of the Arab teacher training colleges, toward the use of photographic images in teaching geometry in the context of Arab-Islamic civilization as part of the course: Arab-Islamic Civilization.

Method

Research Model

The following is a qualitative study. The choice of the qualitative method is derived from the need to explain positions from the various personal perspectives of the participants themselves. The qualitative research method enables openness and the ability to clearly understand the opinions of teachers and students on realization of significant learning through integration of photographic images in teaching (Tsabar Ben-Yehoshua, 1999; Shkedi, 2003)

Participant

Twenty-four teachers in the academic retraining program, to become mathematics and computer sciences teachers, and 26 regular students in their fourth year, majoring in mathematics and computer sciences. The teachers and students participated in the compulsory course: Arab-Islamic Civilization at an Arab education and teacher training college.

The teachers in retraining are actual teachers with 5-10 years of teaching experience, some of whom teach mathematics in grades 3-6 and other 7-8, and the purpose of their studies is to train them to teach mathematics. At the end of their studies, they receive a teaching certificate in mathematics, recognized by the Ministry of Education. The students in the regular track are in their fourth year of study towards receiving a B.Ed., majoring in mathematics and computer sciences.

Data Collection Tools

In this study we used a questionnaire with one version for both groups of participants – teachers in retraining and regular students in their fourth year of study in the teaching of mathematics and computer sciences. The first two question are intended to provide initial personal information (profession, and math teaching experience):

Q1. How many years have you been teaching the mathematics subject?

Q2. How long have you been teaching at your present school?

Questions 3-13 are open questions providing information with regard to teachers' and students' positions on the study topic. At the end of the questionnaire, the participants were asked to make additional comments:

Q3. What does the expression "integrating a photographic image as a teaching or learning method" mean to you?

Q4. To what degree are pictures as a teaching method in mathematics used in the school in which you teach in general, and in the classes you teach, in particular? Provide examples.

Q5. Describe the difficulties you've encountered, as a teacher in the retraining program and as a regular student in the college, in choosing the appropriate picture for preparing a lesson for thought in geometry.

Q6. Why did you prefer that particular picture over the others?

Q7. In your opinion, what is the educational benefit of using photographic pictures in teaching geometry?

Q8. What benefit does the use of photographic images in teaching geometry have in the development of your professional career.

Q9. In your opinion, what is the benefit of this method for the students?

Q10. Define what the "significant teacher" is, from your point of view.

Q11. Do you see yourself as a creative teacher in the use of photographic images as a means of teaching geometry? Explain your opinion.

Q12. Would you recommend to your colleagues to integrate photographic pictures in teaching geometry in your school?

Q13. Evaluate the lecturer in the course: Arab-Islamic Civilization, as far as delivery of the material and use alternative teaching methods.

Any further comments you might like to add:The questions in the questionnaire are open and are intended to enable a deepening of understanding with regard to participants' answers based on the qualitative methodology. During the intensive one-week trial period, observations in classes were conducted in addition to interviews with some of the participants in the study.

Implementation of the Course

The participants in the study were asked to construct a 45-minute lesson in geometric thought through a practical assignment. It was made clear to both teachers and students that the data collected shall remain confidential and be used for research purposes only. In addition, they received a detailed explanation on the importance of the study and that its purpose is to instruct them in integration of photographic images in teaching geometry. All of the teachers and students agreed to participate in the study and were invited in small groups for individual meetings. It was explained to them that

the purpose of the study is effective use of photographic images in teaching geometry. The participants prepared the practical assignment according the previously explained stages.

Results

The findings connected with the teachers' and students' positions regarding integration of photographic images in teaching geometry were obtained from the researchers' assessment of assignments execution, observations in the students' lessons during the week-long practicum the students carried out at schools, from reflection, and the opinion questionnaire.

The findings attest to positive attitudes toward the use of photographic images as a tool for significant learning. The students viewed the assignment as one that serves their professional development in teaching and assists them in effective delivery of classes. This despite the difficulties the students had to deal with in choosing a culturally relevant picture in optimal compliance with all the guidelines. With regard to professional experience, a close correlation was found between professional experience and knowledge of the teaching field, and preference for the use of photographic images as a didactic tool.

The teachers in the retraining program admit that preparation for lessons in which photographic images are used is different from preparation for lessons according to the frontal method. In their opinion, teaching that includes the use of photographic images assists in conveying the subject matter visually, which contributes to comprehension. Furthermore, they admit and say that Confucius was indeed right when he said: "A picture is worth a thousand words". The use of pictures makes learning more interesting and contributes to social involvement and value orientation. In light of the above, it should be noted that some of the students' feedback was received after delivering a geometry lesson by this teaching method during the intensive week-long practicum (a week that all students spend performing practical work at schools).

Both teachers and students related, among other things, to the difficulties they encountered while performing the assignment. The most prominent difficulty was choosing the picture relevant to the studied material, its goals, the curriculum, the target population, and how to construct a lesson accordingly. Nevertheless, despite the difficulties, both teachers and students saw the assignment as a challenging task that serves their professional development in teaching and assists in the successful delivery of lessons. What's more, the photographic images chosen were within their own world, civilization, heritage, and religion.

In light of the experience in constructing lessons based on pictures, the students' awareness, and openness regarding the use pictures in teaching have increased, not just in mathematics and computer sciences but in other disciplines as well such as history, religion, and more. Therefore, they recommend to their colleagues, teachers at schools, to employ this teaching method both due to its effectiveness and since it makes lessons more successful, experiential, and interesting.

The following is an analysis of the findings connected with the questions that appeared in the opinion questionnaire, according to the following categories:

Difficulties of understanding the practical assignment

An examination of several participants' comments gives rise to several difficulties: In the following are several comments:

> *"At first it was hard to choose a picture relevant to the lesson, its goals, and the target audience. To what degree will I succeed in choosing a suitable picture, that will encourage the students to be more active and significant in the lesson and make the lesson significant and interesting."*

> *"I didn't have any prior knowledge of the importance of using pictures in teaching geometry, as a means of achieving significant learning. I felt confused. The fact that it was my first attempt to construct a lesson for thinking in order to achieve the educational goals; however, the guiding lecturer's guidance and instruction helped in preparing the lesson."*

"When proceeding to choose a picture, all kinds of questions and dilemmas arose with regard to delivering the lesson for 45 minutes. However, after meeting with the guiding lecturer for guidance and consulting I found the will and courage to succeed and overcome the difficulties."

"The difficulty I encountered was the fact that the course's connection with Arab-Islamic civilization, and my being of a different faith. However, the beauty of the pictures chosen from the world of pure Islamic art enabled me to overcome this difficulty, by accepting the other's civilization."

Type of picture and reasons for choosing it

Forty-five of the participants chose pictures with an affinity to their identity and civilization and to clear social values. For example, the Kaaba in Mecca, the Taj Mahal in India, the pyramids in Egypt, the Dome of the Rock, the Hisham Star in Jericho, and more.

Participants noted several reasons for choosing a picture:

- The choice of picture is connected with the spiritual-moral aspect, holy sites, and pure Arab-Islamic art.
- The choice of picture derives from appreciation of Arab-Islamic art and its holy sites.
- The chosen picture symbolizes a value held in esteem by the student or civilization, such as respect for art, progress, modesty, equality, accepting the 'other', and more.
- The chosen picture strengthens the connection to a religion, or affinity to the other's civilization and heritage.

Contribution of the use of pictures to professional development

Both groups participating in the study related to the same contribution, noting that the use of pictures in teaching geometry is considered a means of realizing significant learning. This tool increases students' interest in the class, more than the traditional frontal method. One of the teacher's noted in his evaluation: "This course gave me a great deal professionally, and familiarity with a new teaching aid that may be integrated in the teaching of geometry. Another teacher noted: "Without flattery, I can say that without this course I would not have become familiar with this tool." Another teacher said: "This course was of high quality and I really learned a great deal about how to use technological tools in conducting the lesson and delivering the subject matter in a different way, thus making the lesson more significant and experiential. Inclusion of pictures as a teaching aid assists in getting students' attention in class, arousing their senses, and increasing their motivation and desire to learn, more than the traditional frontal method."

Contribution of the use of pictures to the class atmosphere

From the participants' standpoint, it was found that choosing the relevant means of delivering the subject matter in geometry improves the class atmosphere, reduces discipline problems, and strengthens students' persistence in regular attendance in class. This method is characterized by the fact that it arouses the student's visual senses and spurs him to more focused and challenging learning, as opposed to traditional methods.

Contribution of the use of pictures on the moral level

in addition to the study content, this teaching method contributes to strengthening the student's social and human values; for example, cultural pride, sense of belonging, tolerance, and acceptance of the 'other'. Furthermore, it contributes to strengthening his identity and knowledge of his heritage.

The creative teacher

The participants were asked to define a significant teacher from their standpoint. The following definitions were given:

- The creative teacher is the one who can open his students' cognitive horizons, arouse active participation in class and cultivate positive traits among them, such as curiosity, diligence, and self-esteem.
- The creative teacher is the one who chooses the relevant means of conveying the material to students, and at the end of each lesson makes a personal assessment and reflection of the degree to which the lesson's goals were applied in the activity (before, during, and after). The participants added the following statement to this definition: "What counts is the quality of the teacher and not the method. A significant and successful teacher

is one who chooses the relevant means of delivering the material in practical terms and leads to discussion and students' involvement in class."

- The creative teacher is one who develops professionally and becomes more creative by preparing activity that encourages creativity among the students and applies high order learning strategies such as asking questions, solving problems, and more.

The lecturer's contribution

The participants noted that the lecturer successfully delivered the course: Arab-Islamic Civilization in an accessible way, by including technological tools in order to achieve significant learning, which contributed greatly to the participants' career development. Furthermore, the lecturer enriched their world with knowledge on Arab-Islamic civilization and its contribution to humanity. Furthermore, they noted that the teaching method of using pictures in teaching geometry is considered as a more effective means than the traditional frontal method.

Conclusion

The findings of the study attest to the fact that the teaching method of using a photographic image associated with the people's civilization is considered as one of the most effective means of teaching geometry, and preferable to the traditional frontal method for the following reasons:

- Teachers in retraining and regular students in their fourth year of studies constitute a relevant group for training and guidance in integrating innovative and challenging means of teaching mathematics to achieve significant learning. This is because, on the one hand, retraining teachers seek to develop professionally and, on the other hand, regular students in their fourth year are supposed to begin teaching at schools. Both groups see the importance of having an elaborate toolbox to assist them in delivering the content to students in an interesting and experiential way, mainly in teaching geometry.

- The participants in the study reached the conclusion that the picture chosen as a means of realizing significant learning in teaching geometry should be relevant to the curriculum, the target audience, the subject matter, and the lesson objectives. In addition, they have learned that in order to make the lesson experiential, interesting, and comprehensible, the students need to be involved in the discussion about what they viewed, in order to raise their intrinsic motivation and spur them to active participation. The discussion will contribute to the students' development from the cognitive, emotional, social, and moral aspects.
- Both teachers in retraining and students in their fourth year of study attest to having gotten a golden opportunity to learn about integrating a visual element associated with their civilization. This has strengthened their belief in the effectiveness of using pictures in teaching in general, and in mathematics and geometry in particular.

During observation by college instructors in the lessons of the new teachers during the intensive one-week trial period at the college (in which all teachers and students prepare and deliver lessons), and from checking the lesson plans it is clear that the teachers and students have chosen to use pictures in their lessons. As a result, the students responded to it and demonstrated active participation in class. In addition, the students solved geometry problems as an experience and with pleasure.

The teachers in retraining and regular students in their fourth year of studies noted: "In order to integrate pictures in teaching and implement the method in schools, access to the following means is required:

- Computer rooms equipped with the necessary infrastructure, such as an internet network and various software programs, to enable searching for pictures in various databases and websites relevant to the subject matter.
- An interactive whiteboard and projectors for effective delivery of the lesson.
- A hall with proper conditions (air conditioning, suitable furniture, and a large screen) for proper delivery of the lessons.

From the participants' standpoint, the key to success in realization of significant learning is advance preparation and the degree of relevance of the picture as a means for the target audience, the curriculum, the lesson's objectives and

content, and selection of the relevant work method through activity before presenting the topic (picture), during the lesson and at the end of dealing with the subject, with consideration for the students' motivation, their diversity, levels of thinking, functioning, presentation of questions, and creativity.

It should be noted that both teachers and students note that the various activities and tasks prepared while integrating the photographic image in teaching geometry contribute to their professional development. In addition, they note that from their point of view, this is the most suitable and effective way of delivering the content. What's more, they themselves chose pictures that expressed their cultural world. This process contributed to increasing the students' motivation, interest, and desire to learn.

The use of photographic images as a visual aid in teaching appeals to students of all ages – from kindergarten to high school. Even at academic institutions, pictures assist in realization of significant learning while making lessons experiential and not boring. The teacher, in addition to his role as guide, has become the mediator between the material and the student, directing and encouraging his students to learn differently while developing creative 'out of the box' thinking, as opposed to that practiced in the traditional frontal method.

It should be noted that participants recommend to their counterparts to integrate photographic images in teaching, as they have found this tool relevant in communicating messages and knowledge to students on a voluntary basis, without coercion. Lessons delivered by this means contribute to realization of significant learning and are unique in their conception of the subject as being integrated with other disciplines such as civilization, heritage, history, religion, art, architecture, languages, and more, conveyed in an enjoyable and experiential way.

From our point of view, the advantage of the use of pictures both as a cultural treasure and as a means of deepening the understanding of the place's value. The study of mathematics may deepen students' appreciation for cultural treasures (for example, appreciating the magnitude of the cultural achievement) and the cultural context can give real motivation to practice and deepen involvement in teaching mathematics.

Recommendations

The model of using photographic images in teaching mathematics in general and geometry in particular can be used by teachers as an alternative tool for learning and teaching, creation of teaching units, and development of a teacher's training course for their professional development. Furthermore, we recommend that lecturers at academic institutions integrate this tool in their curricula, in the teaching of mathematics, as a means of introducing students to a successful, interesting, and experiential method that may increase students' motivation to study mathematics.

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