

## The role of the cube strategy in cultivating imagination skills among tenth-grade students in scientific and humanities disciplines

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### Abstract

The current study aimed to investigate the effect of using the cube strategy on developing the imagination skills of tenth-grade students in scientific and humanities subjects. To achieve this, a quasi-experimental approach was adopted. The study was conducted with an experimental and control group, consisting of 160 tenth-grade students from Jordanian public schools, in the subjects of history and biology. The study concluded that the cube strategy has a statistically significant effect on enhancing the imagination skills of tenth-grade students, favoring the experimental group. Additionally, the study found a statistically significant difference in the development of students' imagination skills based on the type of educational material, with a greater impact observed in the humanities. Based on these findings, the study recommends the use of the cube strategy in teaching humanities subjects, especially those characterized by chronological progression and developmental themes.

**Keywords:** Biology; cube strategy; history; imagination skills; tenth grade.

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## 1. INTRODUCTION

The higher basic education stage is considered one of the most important educational stages in the life of students, as it is the stage that precedes the secondary education stage, and serves as a guide for students to choose their academic majors in the future. This requires those in charge of educating students to provide them with many advanced skills in dealing with various educational materials. In addition, the development of aspects related to their imagination skills. Because it has a positive impact on their learning and academic progress (Finn et al., 2023).

In addition, if imagination is of paramount importance in various educational subjects, it is more effective in the subjects of history and biology, because of what they require of the ability to visualize and imagine relationships (van Lente & Peters 2022; Bakhurst, 2024). This motivates students to perform many mental operations and build mental images of events and relationships (Comaroff & Comaroff, 2019; Lehtinen, 2024). Mohidat's (2019) study confirmed that it is difficult for students to study past historical events with their personalities and appearances without relying on imagination, due to the lack of information and experiences that students possess.

Historical imagination is one of the most important mental processes that help students solve the problems they face, by imagining past events and linking them to current events and situations, and then deducing relationships and using them to interpret the present situation (White, 2014; Law, 2023). The importance of historical imagination also lies in developing students' sense of the past and its events and being proud of what the ancestors have left throughout the ages (Nørgård & Holfod 2024), as well as revealing the latent capabilities of students and investing them properly in the educational process. Historical imagination also contributes to developing the ability to process information, critical thinking, problem-solving, and decision-making (De Groot, 2015).

Historical imagination skills also help students to study and live past events, imagine historical stories, make objective judgments on some of them, and come up with new reasons behind the occurrence of some of those historical events. Similarly, imagination aids in visualizing theories of evolution and the progressive changes in the characteristics of living organisms over time. This process involves constructing relationships to explain these changes, shaped by numerous successful events across different eras (Listiana et al., 2016).

Biology, by its nature, contains much evidence of the evolution of living organisms, which has been reached through the comparative anatomy of many structures of organisms that have been found, and preserved through time. Thus, it constitutes a time series and successive events that could be imagined and perceptions built about (Aikens & Dolan, 2014). In this regard, several studies recommended the need to use modern strategies that depend on the learner's positivity and participation in the educational situation, allowing him the opportunity to develop historical imagination skills (Dilek, 2010).

One of these strategies is the cube strategy which directs students' interests and involves them in the educational process. By expanding their ideas and making them more in-depth in seeing the subject from its various aspects, which are represented in the faces of the cube, namely: description, comparison, correlation, analysis, transformation, and proof. Each face of the cube looks at the subject under study from a specific perspective (Prange & Schlegelmilch, 2018).

Since this strategy requires teamwork among students, it is thus considered one of the cooperative learning strategies that would work on developing students' higher levels of thinking, such as interpretation and installation, imagining Generalization, and criticism. It also gave students an increased sense of confidence in expressing their viewpoints (Moriau, et al., 2022).

In this regard, many studies and research have confirmed that the cube strategy facilitates students' learning of knowledge and develops their mental abilities. Among these studies is the study of Rahim and Abbas (2013), which proved the effectiveness of the cube strategy in developing metacognitive thinking and imagination skills among fourth-grade students in biology. Likewise, the study by Ahmed (2019), showed the

effectiveness of the cube strategy in developing imagination skills and the attitude toward teamwork among fifth-grade students in social studies.

### **1.1. Conceptual background**

The Cube Strategy “is a method that helps students organize information about historical events by looking at the event or subject from six aspects: description, comparison, correlation, analysis, transfer, and proof” (Ahmed, 2019). The cube strategy is based on the principle of organizing students' knowledge and self-learning, as it works to stimulate the student's thinking when reading, by looking at the subject through six aspects, which are the six sides of the cube, which allows students to analyze the subject in deep analysis. Cube strategy is a strategy that makes the learner practice various types of thinking, as each of its aspects has a specific thought process that the learner performs; It is a visual method that helps students organize complex information by looking at it from six sides.

#### **1.1.1. Cube strategy phases**

1. Description: Students discuss the question related to the characteristics of the subject (concept or phenomenon) and its characteristics.
2. Comparison: In it, the students discuss the similarities and differences between the subject (concept or phenomenon) and other things around it.
3. Connection: Students search for things that are related to the topic, or make students think about the topic when it is raised.
4. Analysis: The students discuss the components of the topic (concept or phenomenon), i.e., what does it consist of?
5. Transfer: Pupils investigate the uses, function, or usefulness of the subject (concept or phenomenon)
6. Evidence: Students employ (the concept or phenomenon) in life while supporting it with new examples (Yu et al., 2020).

Thus, the cube strategy makes the student flexible in his thinking and has a deep vision of the subject resulting from seeing the subject from different aspects, and then understanding the subject more comprehensively. It is built based on the six faces of the cube.

#### **1.1.2. Cube strategy objectives**

The use of the cube strategy in teaching achieves several objectives, including:

1. Developing the linguistic intelligence of the learners through discussions that take place during the formation of the cube.
2. Developing logical intelligence in mathematics through brainstorming by learners to include ideas in the six faces of the cube.
3. Developing visual-spatial intelligence through the shape of the cube, as it makes the information related to concepts or topics organized in a visual way that can be seen, and then it is easy to remember and recall the information.
4. Developing personal intelligence through the learners forming the cube in the form of cooperative groups.
5. Looking at the topic or concept from six different angles, thus giving learners a deeper and broader understanding of the topic.
6. Encourage the learners to become more flexible in their thinking because of their view of the subject from multiple perspectives.
7. allow the teacher to ask his pupils about the subject or concept from various aspects.

8. Learners develop thinking skills, especially in the three faces of the cube (analysis, transformation, and proof) (Núñez-Núñez et al., 2018).

### **1.1.3. Advantages of using the cube strategy**

1. The cube strategy at the highest level involves thinking skills.

2. The cube strategy is a simple method of differentiation, by teaching learners the same topic, or the same skill, and the tasks or duties of the learners are different according to the faces of the cube to suit the different groups.

3. Rotating the faces of the cube gives the learners an atmosphere of joy and anticipation. It removes what could be boring homework and encourages the learners to have fun and participate in the educational process.

4. The cube strategy is an excellent strategy for learners to learn (tactile, kinesthetic) by assembling and shaping the faces of the cube.

5. Each face of the cube contains specific tasks to suit different groups' ability levels (Putz, 2019).

With the development of curricula and textbooks in the Hashemite Kingdom of Jordan, and based on the reality of the work of researchers in teaching social studies and biology subjects. We find that the teachers of these subjects, despite their different nature from human to scientific, still follow the traditional methods of teaching students. Knowing that both articles contain many chronological topics. Which can be dealt with as historical events, whether they are related to theories of the evolution of living organisms. Alternatively, is it related to the history of the ancestors and the ancients and what they gave us of experiences and knowledge?

Likewise, the researchers noticed a weakness in the imagination skills of tenth-grade students in constructing, analyzing, and interpreting abstract scientific topics and previous historical events. From here, the idea emerged to identify the impact of using the cube strategy in developing the imagination skills of tenth-grade students, according to scientific and human subjects.

The research questions are as follows:

1. Is there an effect of the cube strategy on developing the imagination skills of tenth-grade students?

2. Are there any differences in the effect of the cube strategy on developing the imagination skills of tenth-grade students, depending on the scientific and human subjects?

The research hypotheses are as follows:

1. There is no statistically significant effect at the significance level ( $\alpha = 0.05$ ) of the cube strategy in developing the imagination skills of the tenth-grade students.

2. There are no statistically significant differences at the significance level ( $\alpha = 0.05$ ) in the effect of the cube strategy on developing the imagination skills of tenth-grade students, according to the scientific and human subjects.

### **1.2. Purpose of study:**

The purpose of this study is to assess the current level of imagination skills among tenth-grade students in Jordanian public schools and to examine the effectiveness of the cube strategy in enhancing these skills. Additionally, the study seeks to determine whether the impact of the cube strategy differs between scientific and humanities subjects, providing insights into how this approach may support subject-specific learning needs. The importance of the current research is to make a kind of comparison in the impact of the cube strategy in developing the imagination skills of tenth-grade students. For both the human and scientific aspects of the subjects and courses that are taught to students. This may contribute to determining the effectiveness of this type of strategy, depending on the nature of the subjects taught to students. Thus, directing the attention of program developers to choose the most effective strategies for teaching students on the human

and scientific sides. In addition, not to confuse them, the importance of this study is highlighted in providing a practical model for both social studies teachers and biology teachers in how to use imagination in clarifying abstract concepts, and then analyzing and interpreting them.

## 2. METHOD AND MATERIALS

To achieve the objectives of the study, the semi-experimental approach was followed, by applying the study tools to the study groups, which consisted of testing the imagination skills and implementing the cube strategy on two study units from the history book and the biology book for the tenth-grade students in Jordan.

### 2.1. Participants

The study population consists of all tenth-grade students in the Jordanian public schools affiliated with the Jerash Education Directorate, whose number is (4141) students, for the academic year (2022/2023 AD). A random sample was selected from public schools affiliated with the Jerash Education Directorate, from schools in which there are two or more classes of tenth-grade classes, and thus four classes were chosen in each class (40) students, with a value of (160) students, to apply the study tools to them.

### 2.2. Data collection tools

To achieve the objectives of the study, the imagination skills test was relied upon, which was prepared by the two researchers, so that it is applied to the students of the two experimental groups that were taught according to the cube strategy, as the test consisted of (20) multiple-choice items, simulating many general topics. The test was not directed to one group and not the other.

#### 2.2.1. Validity of imagination skills test

The validity of the test was verified by presenting it in its initial form to (5) arbitrators specialized in social studies and biology at the Jordanian Ministry of Education. In addition (3) arbitrators from educational measurement and evaluation experts. To express their opinion on the clarity of the paragraphs and their suitability for the target group and in the light of their observations. Some paragraphs were modified in terms of wording, and it was applied in its final form to an exploratory sample from outside the study sample to calculate the reliability coefficient according to the (KUDER-RICHARDSON 20) equation. The reliability coefficient was (0.86), and this was considered a good and sufficient statistical indicator for the study.

#### 2.2.2. The psychometric characteristics of the test were verified as follows

Difficulty and discrimination coefficients: Difficulty and discrimination coefficients were calculated for each item of the test, as shown in Table (1).

**Table 1**  
*Difficulty and discrimination coefficients for science operations test items*

NO	Difficulty	discrimination	NO	Difficulty	discrimination
1	0.45	0.46	11	0.44	0.45
2	0.7	0.30	12	0.69	0.30
3	0.42	0.35	13	0.41	0.34
4	0.68	0.30	14	0.67	0.31
5	0.44	0.30	15	0.43	0.32
6	0.55	0.51	16	0.54	0.50
7	0.6	0.30	17	0.59	0.29
8	0.68	0.35	18	0.67	0.34
9	0.65	0.31	19	0.64	0.30
10	0.55	0.41	20	0.54	0.40

Table No. (1) Shows that the difficulty coefficients for the test ranged between (0.41-0.67). Accordingly, all difficulty indicators of the test are acceptable, and within the normal range. As shown in the previous table,

the discrimination coefficients for the test items ranged between (0.30-0.51). Accordingly, all discrimination treatments are considered acceptable and within the normal and appropriate limits for conducting the study.

Test reliability: To check the reliability of the test, test reliability was used (Test-Retest), and the correlation coefficient was calculated between the results of the pre-and post-applications, where the calculated correlation coefficient was (0.88). Method (0.91) and this value is considered good for this type of test. Which indicates that the test has a suitable and acceptable degree of reliability; applied to the study sample.

### 2.3. Procedure

The application of the strategy requires encouraging students to practice critical thinking so that they can build their meaning and discuss the topic from six different points of view. Teaching takes place according to the following steps:

1. The students are divided into groups representing each group of one of the six faces of the cube, so that the groups are arranged according to the levels of readiness and interest of the learners from the least complex level to the most complex level, starting from (description, comparison, correlation, analysis, transformation, and proof).
2. The teacher provides the students with information about the cube and trains them on how to form it and identify the aspects of the cube that are consistent with the target basic concept.
3. The teacher sets tasks, clarifying the nature of the work of each of the groups.
4. The teacher presents the lesson with one of the common teaching methods, such as discovery, problem-solving, investigation, or others.
5. According to the faces of the cube, the students collect and discuss the information that should be included in each face of the cube.
6. Students write the information they found on each face of the cube.
7. Each group reads the information it has reached to the members of their group to negotiate and discuss the main ideas among them and to organize the group's summary.
8. One student from each group reads his group's ideas and information about the face that was represented by the faces of the cube to the rest of the groups that represent the other faces of the cube to cover all aspects of the topic or concept (Bahruddin & Budianto, 2020).

**Table 2**

*a sample activity sheet for evaluating concept learning from six aspects*

Instructions: Fill in the blanks according to your own opinion	
description	What characterizes birds?
Comparison	Compare a dove and a bat.
correlation	What animals are associated with the concept of birds?
analysis	What are the parts of the bodies of birds?
transfer	What is the benefit of birds?
proof	Defend it or against it, what is the importance of birds in our lives? Q1: Do birds benefit? Q2: What do you expect to happen in nature if there are no birds in it? Support your answer with suitable examples.

### 3. RESULTS

The first hypothesis: There is no statistically significant effect at the significance level ( $\alpha = 0.05$ ) of the cube strategy in developing the imagination skills of the tenth-grade students.

To test this hypothesis, a one-way ANOVAa test was used as follows:

**Table 3**

*A one-way ANOVA test to examine the impact of the cube strategy on developing the imagination skills of the tenth-grade students in the post-test, according to the group (experimental, control).*

N	Mean	test	Sum of Squares	df	Mean Square	F	Sig.
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Experimental	80	17.95	Between Groups	975.156	1	975.156	541.016	.000
control group	80	13.01	Within Groups	284.788	158	1.802		
Total	160	15.48	Total	1259.944	159			

Table (3) shows that there is a statistically significant effect at the significance level ( $\alpha = 0.05$ ) of the cube strategy in developing the imagination skills of tenth-grade students. This result can be inferred through the value of the significance level, which was less than (0.05). Hence, rejecting the null hypothesis and accepting the alternative. It is also evident from the values of the arithmetic mean that the direction of the differences is in favor of the students of the experimental group. The mean for them was (17.95), while it was (13.01) for the students of the control group. It is a noticeable and statistically significant difference, as shown by the results of the one-way ANOVA.

The second hypothesis: There are no statistically significant differences at the level of significance ( $\alpha = 0.05$ ) in the impact of the cube strategy on developing the imagination skills of tenth-grade students, depending on the scientific and human subjects.

To test this hypothesis, the one-way ANOVA test was relied on to examine the differences among the experimental group students as follows:

**Table 4**

*One-way ANOVA test to examine the impact of the cube strategy on developing the imagination skills of the students of the experimental group, according to the scientific and human subjects.*

	N	Mean	test	Sum of Squares	df	Mean Square	F	Sig.
History	40	18.58	Between Groups	31.250	1	31.250	23.314	.000
Biology	40	17.33	Within Groups	104.550	78	1.340		
Total	80	17.95	Total	135.800	79			

Table (4) shows that there are statistically significant differences at the significance level ( $\alpha = 0.05$ ) of the cube strategy in developing the imagination skills of tenth-grade students, depending on the scientific and human subjects. This result can be inferred through the value of the significance level, which was less than (0.05). Thus, the null hypothesis was rejected and the alternative was accepted, as shown by the values of the arithmetic averages that the direction of the differences was in favor of the students who were taught history according to the cube strategy. The arithmetic mean for them was (18.58), while for the students who were taught biology according to the cube strategy, it was (17.33). It is a noticeable and statistically significant difference, as shown by the results of the one-way ANOVA.

#### 4. DISCUSSION

The results of the study revealed that there is a statistically significant effect of the cube strategy in developing the imagination skills of tenth-grade students. This is due to the cube strategy, which is characterized by a set of characteristics and advantages, the most important of which are: It helps students monitor their understanding of the material they read, as it analyzes the content and works to link it to previous knowledge and experiences that it possesses. It also helps students to identify what is unknown. Which develops their thinking abilities and increases their motivation to learn and develop special abilities to clarify relationships. Such as cause and effect, through the organization and interpretation of study materials through dialogue and meaningful discussion.

In addition, when students start answering the questions, they feel more responsible for their learning and play a more positive role. This strategy also strengthens the student's sense of self-efficacy and strength of personality, and they feel self-control over their learning through what is available to them from defining and choosing their own goals. The cube strategy also works to help students practice reflection skills on the products of their thinking and review their plans and action steps. Then evaluate what they have accomplished, and they develop the skill of listening to others when they try to convey their ideas and when

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thinking aloud. The cube strategy is also effective in the context of group work, as students can exchange opinions with each other as sources of questions and answers about the scientific material they are learning.

## 5. CONCLUSION

The results of the study concluded that the cube strategy is more effective in developing students' imagination skills in human subjects (history), as opposed to scientific subjects (biology). This can be explained because history is a living, active, and scientific subject. In addition, it contains many situations and historical events that would open the way for students to practice imagination skills more than the scientific subjects that are dominated by stagnation.

Also what distinguishes Arab and Islamic history from the presence of many events and tournaments since the era of the Messenger Muhammad, may God bless him and grant him peace. This can also be attributed to the existence of many historical films and series, through which many previous historical events emerged. This helped the students to imagine, analyze and relate events, and then interpret them more comprehensively.

In light of the findings, the two researchers recommend the following:

1. Using the cube strategy in teaching humanitarian subjects, especially those subjects that are characterized by chronology and development.
2. Paying attention to developing history curricula and reorganizing their scientific content in line with the characteristics of the Cube strategy, as it has proven to have an impact on improving self-learning processes within groups.
3. Training students on self-organized group work and allowing them to express their ideas.
4. Providing an interactive learning environment for students that enables them to practice imagination skills away from the traditional educational environment that is characterized by stagnation.

The study is limited in the following ways:

- Objective Scope: This study focused on applying the cube strategy to the tenth-grade history and biology curricula used in Jordanian Ministry of Education schools.
- Participant Scope: Tenth-grade students enrolled in public schools within Jerash Governorate, Jordan.
- Geographical Scope: Public schools under the administration of the Jerash Education Directorate.
- Time Frame: The research was conducted during the first semester of the 2022/2023 academic year.

**Conflict of Interest:** The authors declare no conflict of interest.

**Ethical Approval:** The study adheres to the ethical guidelines for conducting research.

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