

The Effect of Binary Encoding Strategy on Visual Thinking and overall Psychology among Third Grade Students in the Faculty of Education in Learning Technology Subject

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Abstract

The importance of the current research lies in the fact that it comes as a result of what contemporary studies call for, which is the development of the human mind in all its aspects. This is achieved through teaching binary coding, which involves encouraging students to use their mental abilities and various thinking skills to learn better. It gives them the opportunity to organize ideas, meanings and clarify the relationships contained in a particular subject of the educational material. It helps students organize their knowledge in order to deepen their understanding. The current research aims to determine the effect of binary coding strategy on the achievement of third-year students of the College of Education in the learning technology course .

The researcher used the quasi-experimental design consisting of an experimental and a control group. The experimental group studied using the binary coding strategy while the control group studied using the traditional method. An achievement test was developed and validated to measure students' achievement .

The results using the t-test showed that the experimental group that studied using the binary coding strategy outperformed the control group that studied using the conventional method. In light of the research results, the researcher recommended the necessity of using the binary coding strategy. The researcher also presented a number of recommendations and proposals, most notably conducting similar studies on other educational stages. As well as identifying the impact of using the binary coding strategy on other variables, such as critical thinking, innovative thinking, visual thinking and visual perception.

keywords: Binary coding, Visual thinking test, Learning technology.

The problem of the research

Binary coding is one of the main cognitive processes that can organize information and knowledge to facilitate learning and control of individual and environmental resources in various life situations. The need for binary coding has become clear due to the rapid development of information and the huge amount of knowledge that the human mind cannot handle .

Many educators have called for overcoming the difficulties arising from this scientific development in all situations, with the main goal being how to manage information and benefit from it through active and skilled thinking to increase the learner's efficiency in facing present and future problems .

However, most students only possess the verbal type of binary coding obtained from books and general knowledge, not the visual type. The problem lies in students having analytical intelligence that helps them judge the quality of ideas, but they lack the ability to generate those ideas (creative intelligence) and apply them to produce something (practical intelligence)

The researchers agree that students with visual intelligence learn more effectively because binary coding provides them with educational images that match their mental abilities, enhancing their strengths and improving their weaknesses. Visual thinking means using images, diagrams, charts, graphs and other visual materials to represent, analyze, organize and clarify ideas and concepts. In light of the above, the problem of the research was determined as follows: What is the effect of the binary coding strategy on visual thinking among third-year College of Education students in the learning technology course?

The importance of the research lies in the following:

Binary coding is considered one of the theoretical approaches in psychology that assumes human beliefs and behaviors stem from simple binary distinctions. According to this theory:

- The human mind tends to simplify classifying things into opposing pairs.
- Binary dimensions like good or bad, right or wrong, familiar or unfamiliar are fundamental in shaping beliefs and behavior .
- Human disputes and conflicts often reflect the tension between these binary distinctions.

According to this view, the mind uses simple binaries as a model for understanding and interacting with the world although reality is much more complex. An excessive focus on binary distinctions has at times led to unfair bias and disregard for experiences that do not fit into either category.

Therefore, binary coding can be an effective educational technique to organize and structure information in a simplified yet powerful way that helps students learn and think visually. The current research aims to investigate the impact of binary coding strategy on developing visual thinking skills among students. This has importance for enhancing students' cognitive abilities related to visualizing, analyzing and utilizing information effectively in the digital age of information overload.

In conclusion, the research intends to provide evidence regarding the effectiveness of binary coding in the educational process, which may help rethink teaching and learning strategies to develop students' visual intelligence.

The researchers see several reasons for the importance of the research:

- 1- Teaching for binary coding leads to a more in-depth and extensive analysis of the curriculum compared to traditional teaching methods.
- 2- Teaching for binary coding encourages the use of more varied forms of encoding curriculum material, which makes it easier to retrieve the material better during exams .
- 3- Binary coding allows students to take advantage of their strengths and compensate for weaknesses .
- 4- Visual thinking helps students focus, understand content, integrate new information with prior knowledge, and encode this information in a way that facilitates recall and retrieval.
- 5- Teaching for binary coding stimulates both the student and the teacher, so the teacher is expected to teach more effectively and students are expected to learn with greater motivation.

Some factors to consider when teaching using the binary coding model:

- Appropriateness: Binary coding may not be suitable for all subjects or students. Assess whether this approach will effectively help students learn and understand the material.

- Complexity: An excessive focus on simple binary distinctions can ignore the actual complexity of the topic.

- Bias: Some binary distinctions can encourage bias against those who do not fully belong to either category .

- Thinking patterns: Binary coding can teach ineffective or inaccurate thinking patterns .

Teachers should avoid excessive focus on binary coding and promote critical and reflective thinking so students can challenge simple binary distinctions and identify cases where they may not apply.

In summary, the importance of this research lies in:

- Enriching the educational theoretical literature.

- Highlighting the importance of binary coding in activating students' analytical, creative and practical abilities and increasing their visual thinking skills .

- Training students to find creative solutions to problems.

- Potential for further brain-based research to solve problems creatively.

- If students' binary coding level is high, utilizing this level to increase their visual thinking skills in all fields of life, both academic and social.

- Meeting the need to review teaching strategies to enhance their role in introducing teaching strategies that provide students with new learning opportunities that make them more positive.

The impact of the binary coding strategy on visual thinking among third-year students of the College of Education in the learning technology course .

The research hypothesis

To achieve the research objective, the researchers put forward the following null hypothesis:

There are no statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group students who study the learning technology course according to the binary coding strategy and the mean scores of the control group students who study the same course in the conventional way on the visual thinking test.

The research is limited to:

- 1- The human limit: Third-year students .
- 2- The time limit: The academic year (2022 – 2023)
- 3- The spatial limit: Al-Qadisiyah University / College of Education / Computer Department
- 4- The cognitive limit: Includes vocabulary of the subject (Educational Technology).

The terms are defined as follows:

Binary coding strategy: Paivio (1971) defined it as multiple mental images stored in the individual's memory through precise procedures after processing these images (Paivio, 1971, p1)

The procedural definition of binary coding strategy is: The steps followed by the researcher to combine listening and viewing through explaining displayed images or films and encoding them in the human mind to retain them as a new symbol within the human mind or update previous information, where the more means of inputting information facilitate its retrieval when evoked.

Visual thinking: It is defined by Wilieman (1993) as the organization of mental images revolving around shapes, lines, colors and components. It is the individual's ability to present information using images and drawings instead of a lot of filler used in communication with others. (Wilieman ,1993: 7)

The operational definition is: A mental activity practiced by college students to analyze, translate images, diagrams into an understandable language manifested in the visual reading of the presented image, perceiving the spatial relations, interpreting and analyzing them, deducing meanings from them, measured by the degree they obtain in the visual thinking skills test prepared by the researcher for this purpose.

The theoretical framework and previous studies:

The first axis/ Binary coding

Binary coding can help learning in different ways, but it is not suitable for all learning styles:

Positive factors:

- Simplification: Binary coding can help students simplify complex concepts and link them in an easy-to-remember way.
- Early understanding: Students can build an initial understanding of a subject matter by focusing on binary distinctions .
- Cognitive styles: Binary coding helps students who learn through images and simple classifications.

Negative factors:

- Excessive simplification: An excessive focus on binary distinctions can ignore the actual complexities.
- Cognitive selectivity: Binary coding tends to highlight only certain information and ignore inappropriate data.
- Incomplete comprehension: Students may not fully understand the essential concepts unless they go beyond the initial binary coding.

Therefore, a focus on binary coding alone can limit long-term learning. Deeper and more complete understanding requires more complex thinking patterns.

The binary coding strategy:

There are some useful strategies for teaching using binary coding:

- Start with basic binary distinctions - Help students begin with the basic understanding of the subject matter by focusing on the simplest binary distinctions. This can help build early understanding and mental organization.
 - Reinforce application - Ask students about different cases of applying the binary distinctions to their real lives. This is helpful for reinforcement of learning .
- Pose exceptions - Ask students to identify cases where the binary distinctions do not accurately apply. This can help build critical thinking .
- Pose questions - Ask questions like "What is lacking in this binary coding?" and "How might an excessive focus on this coding lead to bias?" This encourages critical reflection.
- Explore complexity - After training on initial binary coding, let students explore how reality is much more complex. This is useful for improving long-term understanding.

Overall, it is helpful to start with a simple focus on binary coding, then gradually move toward more complex and critical thinking styles. The important thing is to avoid an excessive or unreflective focus on binary distinctions alone.

Binary coding and visual thinking:

Binary coding:

There are some useful strategies for teaching using binary coding:

- Start with basic binary distinctions
- Reinforce application
- Pose exceptions
- Pose questions
- Explore complexity

Overall, it is helpful to start with a simple focus on binary coding, then gradually move toward more complex and critical thinking styles.

Visual thinking:

Visual thinking is a way to solve problems using mental images and diagrams. There are several potential benefits of this approach:

- Simplification
- Repeated reminders
- Problem-solving
- Brain activation
- Integration of styles

Visual thinking skills:

- Graphic representation
- Visualization
- Focus
- Visual analysis
- Visual memory
- Visual ordering and classification
- Transformation between forms

Therefore, training visual thinking skills involves training the mind to use images and illustrations in many ways to illustrate, organize and remember ideas. This can help enhance learning and problem-solving.

The previous studies:

- Alzlzaly study (2020) Baghdad PhD thesis

The study aimed to identify "the effectiveness of an educational design based on binary teaching strategies in developing linguistic skills and mental flexibility for fifth grade primary school students". The educational design develops linguistic skills and mental flexibility. The research sample consisted of (65) fifth grade primary school students. The researcher followed the descriptive and quasi-experimental research methods in his thesis .

The researcher prepared the following tests:

- Language skills test .
- Mental flexibility test.

The following statistical means were used: The independent samples t-test, the chi-square test, the difficulty coefficient equation, the discrimination power equation, Cronbach's alpha equation, the correlated samples t-test, the McGeegan equation, the false alternative equation. The researcher concluded that the experimental group students according to the educational design outperformed the control group students, after applying the skills tests in favor of the experimental group, after applying the mental flexibility test on both groups and after analyzing the results, it was significant in favor of the experimental group.(Alzlzaly, 2020: 147)

2- Sultan study (2020) Babylon :

The study aimed to identify "the effect of cartoon concepts strategy on the achievement of fifth grade primary school students in science and their visual thinking", The researcher chose the quasi-experimental design (partial control) for two equivalent groups, one of which is the experimental group and the other is the control group, Al- Fāṭimīyah School for Boys in Babylon Governorate was selected purposefully from the community of schools to be the research sample, The research sample consisted of (60) fifth grade primary school students distributed into two groups, (30) students for each of the experimental group which studied using the cartoon concepts strategy and the control group which studied in the traditional way, As for the research tools, the researcher built the research tools which were represented by the achievement test in science consisting of (30) objective questions of multiple-choice with four alternatives, As for the second tool, it was represented by the visual thinking test consisting of (20) questions of multiple choice with four alternatives, he used the following statistical means The t-test for two independent samples and the chi-square equation and the difficulty coefficient of the paragraphs and the discriminatory power of the paragraphs and the effectiveness of the wrong alternatives and Pearson's correlation coefficient and Spearman - Brown coefficient equation and the variance equation and eta square equation To extract the impact size for the variables of achievement and visual thinking

The research concluded a number of conclusions

.The cartoon concepts strategy contributed to raising the academic level of fifth grade primary school students in science .
 .Teaching using the cartoon concepts strategy had an effect on improving visual thinking among primary school students in science. (Sultan, 2020: 106)

The research procedures include the following:

First: The experimental design: Choosing the appropriate experimental design for the phenomenon to be studied in research is essential to reach answers for the research hypotheses and contributes to the experimental control of the research and acts as a work program for how to carry out the experiment and plan the circumstances and factors surrounding the phenomenon studied and observe it (Alftily, 2013: 158) An expression of the design and as in diagram (1)

| | | |
|-------------------------------|-------------------------------|---------------------|
| Post-test | the independent variable | the group |
| Visual thinking skills | Binary coding strategy | Experimental |
| | ----- | control |

The research community consisted of all third year students / Department of History / College of Education / Al-Musaany University / for the academic year 2022 - 2023, and all third year students / Department of History / College of Education / Al-Musaany University. For the above purpose, the researcher visited the registration section in the College of Education and the relevant department, where the number of students was (150) male and female students. The researcher, in a purposive manner, chose the third-year students / History / in a sample of his community. In a simple random manner, he chose section (b) to represent the experimental group whose students will study according to the binary coding strategy. Their number reached (42) male and female students. He chose section (a) to represent the control group whose students will study in the traditional way without being exposed to the independent variable. Their number reached (40) male and female students after excluding two failing students from the previous year.

The research community and its sample

The research community consisted of all third year students in the Department of History at the College of Education at Al Musaany University for the academic year 2022-2023, totaling 150 male and female students. The researcher chose, in a purposive manner, the third year history students as a sample of his research community. In a simple random manner, he chose section (b) to represent the experimental group whose students will study according to the binary coding strategy. Their number reached 42 male and female students. He chose section (a) to represent the control group whose students will study in the traditional way without being exposed to the independent variable. Their number reached 40 male and female students after excluding two failing students from the previous year.

The main points are:

- .1) The research community consisted of all third year history students at the College of Education at Al Musaany University.
- 2) .The total number of students was 150 males and females .
- 3) The researcher selected section (b) as the experimental group who would study using binary coding strategy. This group had 42 students.
- .4) Section (a) was selected as the control group who would study traditionally. This group had 40 students after excluding 2 failing students.
- 5) .The researcher chose the samples in a purposive and random manner.

So in summary, the research community consisted of 150 third year history students. The sample consisted of the experimental group with 42 students who would study using binary coding and the control group with 40 students who would study traditionally.

- The researcher was careful to conduct an equating of the two research groups (control and experimental) in terms of age, educational attainment for educational subjects, educational attainment of parents, and IQ level before beginning the experiment, and found that the two groups were equivalent in the studied variables.

- The researcher identified the scientific subject to be studied by the two research groups during the academic year 2022-2023 according to the terms of the subject, methods of teaching the course for the third grade, in cooperation with the teachers of the subject in the History Department/Faculty of Education/Al-Muthanna University. The course includes topics such as teaching methods, general objectives, stage objectives, behavioral objectives, teaching styles, teaching planning, and how to prepare a plan. To ensure its validity, it was presented to experts and specialists in the field, who expressed their opinions and suggestions, and it was thus formulated according to the proposed modifications.

- The researcher formulated a number of behavioral objectives that describe the behavior of the learner and expect the learner to be able to perform them. The number of cognitive behavioral objectives (117 behavioral objectives) was distributed over the six levels (remembering, understanding, applying, analyzing, composing, evaluating) in order to be adopted in the teaching plans for the two research groups. They were presented to a group of experts in teaching methods to express their opinion on them and the extent to which they meet the content of the subject. In light of their opinions and suggestions, they were modified.

The researcher designed a set of teaching plans for the two research groups, consisting of 28 teaching plans, 14 for the experimental group according to the binary coding strategy, and 14 for the control group according to the traditional method. Samples of the teaching plans were presented to a group of experts and specialists to ensure their appropriateness and measure their compliance with the desired objectives. In light of their opinions and suggestions, they were modified to take the final form.

1- After reviewing a set of tests that measure visual thinking, 30 multiple-choice test items were formulated. The validity of the scale was verified in two ways:

2-For the purpose of verifying face validity, the test items were initially presented to a group of experts and specialists (Mulhiq, 2) to express the appropriateness of the test items and the accuracy of their distribution into the fields they belong to, and the necessary modifications were made in light of their comments.

3- The correlation coefficients between the item scores and the total score of the test were calculated. After testing the significance of the correlation coefficients by comparing them to the table value at the significance level (0.05) and degree of freedom (98) and the total (0.196), all were found to be significant except for one item.

- It was agreed with the Head of the History Department that the researcher will teach the teaching methods himself, and be directly supervised by the subject teacher. The schedule was also coordinated in a way that ensures enough time for each group, as well as the place of teaching.

The experiment was directly implemented on Sunday, March 1, 2022, by applying the scale of cognitive skills, pre-test. The actual teaching started on Tuesday, May 17, 2023, and continued in the following weeks according to the prepared plans.

Second: Interpreting the results of the Visual Thinking test:

The results showed that the experimental group outperformed the control group in the Visual Thinking test, where the use of the binary coding strategy had a positive effect in raising the level of visual thinking skills. This may be attributed to:

1- The binary coding strategy provided the students with enough room to rely on themselves and think in terms of reaching the answer, which made learning technology more lively.

2- The superiority of the students in the experimental group may be attributed to their greater acceptance and inclination towards modern methods of teaching, as their enthusiasm may drive them to explore the aspects of the new strategy they are studying in the learning technology course, and motivate them to follow the course, which increases their understanding more than the traditional method they are accustomed to.

Third: Conclusions: In light of the results reached by the researcher, the following conclusions can be drawn:

1. The use of the binary coding strategy, based on the binary coding theory, in teaching the teaching methods can achieve the desired educational and behavioral objectives for the students at this stage better than the traditional methods; as it provides the learner with a general idea of the subject matter to be studied and works on building a cognitive bridge between what he will learn and his cognitive structure and educational stance, and provides the learner with organized rules that enable him to link the previous information with the new one and consequently to fix and recall it when needed.

2. Teaching according to the binary coding strategy has a greater effect than the traditional method, as it gives the learner a positive attitude towards the educational stance, by stimulating the learner's interest in the subject matter and placing him in an unfamiliar stance for him beforehand and freeing him from the obligations of the traditional method.

3. Teaching with the binary coding strategy contributed to the development of higher cognitive skills in the research sample compared to the traditional method.

Fourth: Recommendations: In light of the results of the research, the researcher recommends the following:

1. Organizing training courses for teachers focusing on the use of modern approaches in teaching educational subjects, including the binary coding strategy.

2. The need for teachers to pay attention to developing higher cognitive skills for their students through the use of appropriate strategies for this purpose.

3. Not focusing only on raising students' grades, as grades are no longer the only problem at present, but rather paying attention to developing students' ability to use different methods of thinking, such as decision-making, problem-solving and higher-order thinking.

Fifth: Proposals: To complement the current research and its development, the researcher proposes the following:

1. Studying the effect of using the binary coding strategy on other variables, such as critical thinking, creative thinking, visual thinking, and visual perception.

2. Studying the effectiveness of the binary coding strategy in teaching other academic subjects and for different educational stages.

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