Design Thinking Among Preparatory Stage Students

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Abstract:

The current research aims to identify: Design thinking among preparatory school students. Differences in design thinking among preparatory school students according to the gender variable. Differences in design thinking according to the branch variable (scientific, literary).

Keywords: Design thinking, preparatory stage, students.

Introduction:

Research problem

Recently, a new trend has emerged in development, problem-solving and decision-making, to relieve stress depends on thinking of sharing with others, it was one of the design thinking skills, which in short means immersion in a person's life, study what he thinks, what he needs, and what he suffers from, put that into a system, design thinking has emerged multiple practices in different educational sectors. Show a clear difference in ideas, design programs and propose solutions, because the beneficiaries of the relationship have become an essential part of the thinking and design process (Al-Naji, 2020: 81).

Every student needs to develop his design thinking capabilities in order to continue the learning process effectively and intelligently and to accept meaningful changes, subject it to criticism and constructive so as not to be a stumbling block in the way of progress and development, therefore, the educational and educational process must focus on this in its core, to know that the mind has its value, knowledge has its impact, and culture and education have its fruits (Nagai and Noguchi, 2003: 430).

Therefore, the problem of the current research is determined by the following question: - What is the level of design thinking among preparatory school students?.

Research importance:

The practice of thinking skills makes the individual possess a set of characteristics and traits, that appear in his behavior later, this characteristic is represented in reducing impulsiveness or recklessness, listening to others with their understanding and empathy, and flexibility in thinking, scrutiny, and control (Al-Thaqafi, 2013: 58). Since design thinking is a methodology applicable in all non-design - engineering fields - and achieving improved future results, for his ability to feel, innovate, and reality to meet a person's needs by designing a specific goal or achieving success (Mahmoud, 2014: 323).

Design thinking is a way of solving problems, it is an assessment of innovation that the individual focuses on, it was a distinctive intellectual practice and deep thinking for innovation processes, which is a deeper understanding of events and concepts. Design thinking has also gained increasing attention in many practical fields, bbecause it has become a major element in the ability to design and achieve goals (Thienene et al., 2017:13).

Research objectives:

The current research aims to identify:

1. Design thinking among preparatory school students.

2. Differences in design thinking among preparatory school students according to the gender variable.

3. Differences in design thinking according to the branch variable (scientific, literary).

Research limits:

The current study was determined by preparatory school students (females, males) (scientific, literary), morning study for the academic year (2022 - 2023), in public schools in Al-Kut Center, Wasit Governorate.

Define terms

Design thinking:

Plattner knew it (Plattner et al., 2009): An analytical and creative process that involves the individual himself in experiments, collecting observations, creating models and redesigning. (Plattner et al., 2009: 30).

Design Thinking Defined by the United Nations Development Program (2017): "A methodology based on finding solutions and human-centered innovation, a process based on five steps: observation, visualization, modeling, testing, implementation. Design thinking puts the people we

design for at the center of the process and invites them to find concrete solutions." (United Nations Development Programme, 2017: 5).

Chapter one

The first axis: The theoretical framework:

- **The concept and origins of design thinking:**

The concept of design thinking appeared more than 70 years ago. It was the product of accumulating academic research and actual practices with continuous development. It was based on a mixture of sciences. The most important of which are architecture, engineering, humanities, and business administration. The design thinking methodology is based on finding solutions to problems from reality and exchanging ideas, it was often used with the aim of analyzing the real problems that an individual faces (Kateb, 2014: 17).

Tim Brown was one of those interested in this field, as we often find his name associated with design thinking, he was the CEO of IDEO Design Agency. It was one of the most famous design agencies in the world whose work is not limited to designing a specific product. Rather, it goes beyond strategies and actions. Brown did was to share with everyone the design method used in (IDEO), he has written a book and many articles on design thinking. Brown was included in the agency, as the design thinking used was not his innovation. Rather, the founder of the company (IDEO) American Professor David M. Kelly, he was one of those interested and researchers in design thinking and has efforts in creating the D-School (D. School) at the American Stanford University (Al-Sharif, 2020: 429).

Developed House Planter (2011) the first two institutions to teach design thinking skills in the world, they were a design thinking school that began operating in 2005 at Stanford University. The second is a college established in 2007 at the Planter Institute at the University of Potsdam, he presented a research program to understand the way in which design thinking develops on the scientific basis (Plattner, 2011: 7).

The importance of design thinking:

Mootee (2011) states that design thinking is of great importance, including:

1. It was a means of enhancing learning by practice and repetition.
2. It was self-challenging for existing disorders, and makes it ideal for dealing with complex problems and ambiguous issues.
3. It generates useful and useful knowledge in a positive way.

4. Focuses on learners' final needs and tries to find opportunities to meet needs that have not yet been met.

5. Be motivated to achieve the goals of the learners.

6. It should be of an exploratory nature that contributes to realizing the prior realistic vision in the planning processes.

7. It was a continuous learning process to expand knowledge, support learning, and build judgments in order to solve ambiguous and complex problems. (Mootee, 2011:5).

Design thinking stages skills:

Design thinking is one of the modern trends in teaching thinking logically, it was a useful methodology for exploring problems, generalizing solutions, and knowing the methods and processes used by individuals, understanding how people deal with complex problems.

Design thinking is a collaborative and participatory experiential process based on learner expectations, get feedback as well as think in an integrated way to provide innovative solutions. Blizzard et al., 2015: 92.

Many studies have identified design thinking skills, including the study (2008, Brown; Morris & Warman 2015). The Design Foundation (D-School at Stanford University 2016) also referred to these as five skills:

First: Empathy

In which the student puts himself in the place of the teacher and tries to imagine his teaching methods, the more imagination, the better results.

Second: Definition:

In this step, the information collected by the student in the first stage is filtered, classifies them into corners and sections so that he can determine the type of problems that exist, and then decides which problem he will solve.

Third: Ideate generation:

At this stage, brainstorming takes place in groups to develop ideas to work on solving the problem, no idea, no matter how simple or impracticable, is excluded, ideas should not be judged, but all recorded. The goal is quantitative, not qualitative, i.e. coming up with the largest amount of ideas. Visual representations can be used from drawings, pictures, or gases to facilitate the absorption of ideas, then tries to connect things together.

Fourth: Prototype:

After reaching a solution, he studies how it will be used and implemented.

Fifth: Experiment and Test:

In which the student tests what he has reached in order to evaluate it, find out whether the model is easy or needs modification (Al-Fouli, 2022: 681).

Brown (2008) identified the stages of design thinking in three stages:

Inspiration: (reaching an important and bright idea).

Visualization: (presenting a conceptualization of the idea).

Implementation: (implementation and implementation of the idea in reality).

As illustrated by Figure (1). (Brown, 2008: 272).

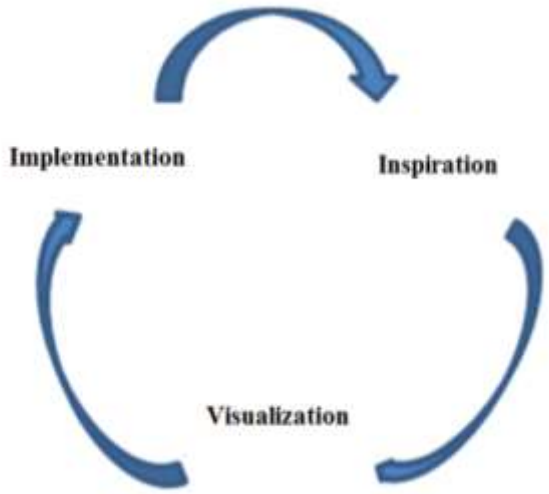

Figure 1: Design thinking stages (Brown, 2008: 272).

Design thinking mechanism

There were four design thinking mechanisms that direct the behavior of individuals and provide the ability to adopt appropriate thinking. These mechanisms include the following:

1. The mechanism of human-centered thinking:

This pattern of human-centeredness was an essential feature of the thinking of individuals, this style inspires people with new ideas, provides them with useful information about the best solutions to meet and achieve the needs of others in the best way, this pattern begins with listening closely to individuals, observing them, and gaining direct experiences, to understand the visions of others and understanding with them.

2. Collaborative thinking mechanism:

This thinking includes forming a multi-opinion team, the involvement of the concerned party (students), in particular, in the design process. It was a pattern that helps to improve practices and solutions, as this multi-opinion team innovates in order to offer more solutions, better than if one person works alone.

3. Optimistic Thinking Mechanism:

This pattern helps learners to see themselves as designers, it enhances their self-belief and inspires hope in them. The failure of ideas in the past does not mean that solutions to problems, that seem intractable does not exist. Research and studies (Beard, Hoy & Hoy, 2010) indicate that one of the most important features affecting the learning environment in schools is academic optimism, it leads to successful teaching and learning, and reduces teacher burnout rates.

4. Experimental thinking mechanism:

The tendency to learn by repetition and trial and error, by applying simple and small experiments early in order to learn from feedback, it was a way to learn and develop ideas. Experimentation differs from mentoring as it is a clear plan for testing an already integrated idea. The test involves finding many prototypes, commonly called rapid prototyping, because it is faster and more frequent than guidance, and the ideas or practices related to it evolve with each iteration (Hammam, 2018: 43-44).

Design thinking and the school curriculum:

Design thinking is part of the curriculum, as schools began to realize the importance of teaching innovation skills in addition to other academic skills, they were not extracurricular activities, and this is indicated by the D-School Foundation at Stanford University, it has developed a one-semester program for new students in the sixth and ninth grades. Over the course of ten weeks, students learn the basics of the Design Thinking approach. A number of schools have integrated the design thinking approach into the curricula. The most prominent of these schools are Nueva School in California, Mount Vernon Presbyterian School in Georgia, Percolage Academy in New Orleans, Father Design School in Delaware, Riverside School in Ahmedabad, Gujarat, India, and the American Community School in Jordan (School at Stanford University, 2016:23). There were several factors that characterize design thinking and make it more suitable for creating solutions and developing the level of thinking, as shown in the table:

Table (1) comparison between design thinking solutions and traditional thinking.

Design thinking solutions	Traditional thinking solutions
What is the right question?	What is the correct answer?
Design with people	Designed for people
Lots of listening	Lots of talking
It is about experiences	It's events
Talks about facts and feelings	Talks about facts
Inventive	Development
It is done with participation and cooperation	Be individually

(Hawari and Al-Mimar, 24:2019)

Theoretical foundations of design thinking:

Among the theories that explained design thinking in educational fields are:

Arnold (1959) theory:

This theory combined the ideas of theorists and researchers in psychology in the field of creativity and innovation, such as Abraham Maslow, Joy Gilford, Robert Hatman, and Engineer Fuller who contributed to the creative engineering symposium at Stanford University. Experimenting with different teaching approaches (Arnold, 1959: 37).

Arnold mentioned a central theoretical belief that mentions the steps to learn design thinking, which were:

Defining the problem and creating solutions, and it seems that Arnold's ideas about problem identification are based on producing a coherent vision of vague and chaotic problems.

1. Defining the problem in a way that stimulates others to think. Arnold showed that design thinking is the result of thinking about a problem that stimulates interest and stimulates mental activity.

2. Creation of ideas increases fluency, and it is one of the main tasks that stimulates the number of ideas generated by the individual over a specific period of time, and the creative individual is more fluent in thinking.

3. Flexibility. Refers to the number of descriptive options that allow the learner to perform experimentation to select the appropriate idea. Meinel, et all, 2010: 33).

Planter (2009) theory:

Planter and others point out that design thinking is thinking that was intended to organize our information about the environment, finding creative solutions that are based on the learner's needs and desires, this

kind of thinking is done through cooperative learning, or the thinking process takes place in a way in which the learner does it individually, to apply design thinking, the five skills must be followed, which serve as stages of design thinking, according to what was proposed by the House Planter Institute in Stanford, known as the de school curriculum, he presented a model of design thinking skills that is a framework for problem-solving and is ideal for addressing undefined or unknown problems, according to Planter, design thinking results in innovation by combining three basic components:

Technical and technical ability, economic ability and sustainability, human desire, it combines what is desirable from the point of view of individuals and what is possible from a technical point of view, and what is feasible for the application of design thinking, the five skills must be applied, namely: (empathy, identification, visualization, model building, and testing).

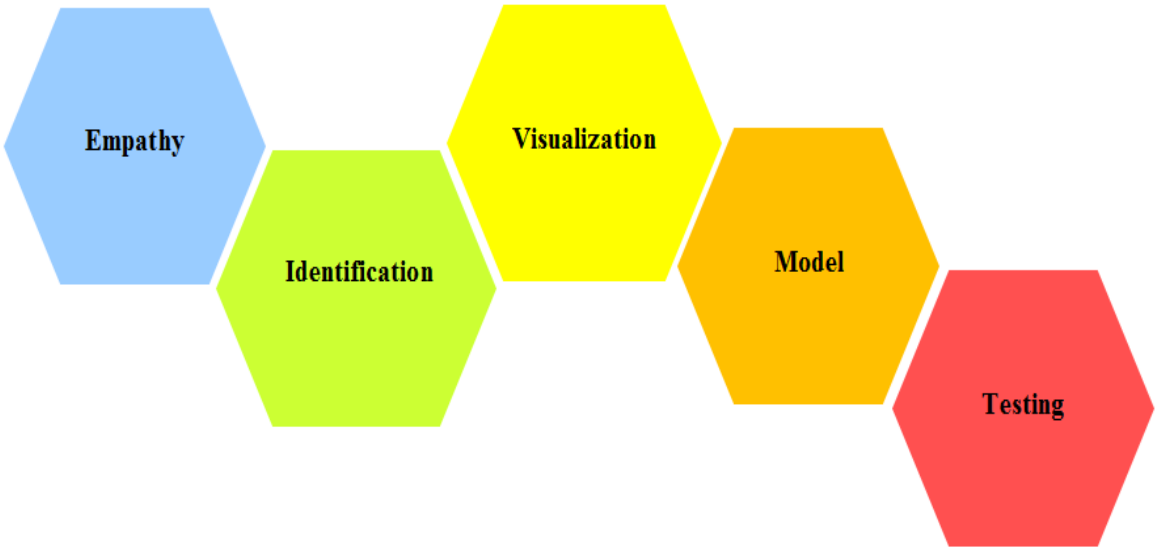

Figure (2) Design Thinking Skills (D. school, 129: 2016).

The second axis: Previous studies:

Design thinking studies

- **Hammam (2018) study:**

The effectiveness of a proposed unit in the light of the STEM approach to develop design thinking in science for students of official language schools

Study objective: To identify the effectiveness of the proposed unit.

Study sample: Sixth grade primary students, numbering (35) male and female students.

Study tool: The research used the descriptive analytical approach in preparing the proposed study unit.

Results : It resulted in a statistically significant difference between the mean scores of the experimental group students in the pre and post applications of the design thinking scale in favor of the post application. Evidence for the effectiveness of teaching the proposed unit in the light of the STEM approach to develop design thinking in science among students of public schools of languages (Hammam, 2018: b).

Latif (2021) study:

Design thinking among students of fine arts institutes:

The aim of the study: To identify design thinking among students of fine arts institutes and to find differences in design thinking according to the variables of gender and specialization.

Study sample: Students of fine arts institutes, their ages range from (15-19). The sample consisted of (250) male and female students from the fine arts institutes in Baghdad, who were selected in a stratified random way.

Study tool: The design thinking scale was applied to them.

Results: The results revealed that the students of the Fine Arts Institutes have a high level of design thinking. (Latif, 261:2021).

Chapter two:

Research methodology: The researcher used the descriptive approach, and the descriptive research method is one of the most widespread types of research, which is a survey that deals with an educational, psychological, or social phenomenon with the aim of diagnosing it, revealing its aspects, and determining the relationships between its elements. (Al-Zubaie et al., 1981: 53).

Search procedures:

First: The research community: The research community includes (4066) preparatory school students.

Second: the research sample: The research sample consisted of (250) male and female preparatory school students in Al-Kut Center, which were chosen by a simple random method with a proportional distribution (100) male and (150) female students.

Third: The research tool: The researcher adopted the design thinking scale (Latif, 2021), which consisted of (21) paragraphs and was organized in a self-report manner. The answer alternatives were five-point Likert

alternatives, based on the choices (strongly agree, agree, disagree, disagree, strongly disagree), five degrees are given for (strongly agree), four degrees for (agree), three degrees for the alternative (I have no opinion), two degrees for (disagree), and one degree for (strongly disagree), tThen the scores of the whole scale are collected, and the scale in the original study obtained high validity and reliability coefficients. The stability coefficient was (0.87) using Cronbach's alpha method, it was characterized by three types of validity, correlative validity, content validity, and arbitrators' validity.

The validity of the scale

A. Apparent validity: The scale was presented in its initial form to (10) experts in the field of educational and psychological sciences, and the agreement on all items of the scale was 80%, which indicated that the scale is apparently true.

B. Content validity: The content validity was extracted by extracting the discriminatory power of the scale using the two end groups by taking the highest 27% of the sample answers, and the lowest 27% of the answers, and extracting the Pearson correlation coefficient between the two groups, and all items were significant.

Paragraph homogeneity (the relationship of the paragraph with the total score):

The correlation of the paragraph score with the total score of the scale is an indicator of the validity of the paragraph. The higher the correlation coefficient of the paragraph score with the total score, the greater the probability of its inclusion in the scale (Table 2) (Abu Hatab, 1976: 201).

Table (2) The relationship of the paragraph score with the total score of the Design Thinking scale.

No.	correlation	Sig. level	No.	correlation	Sig. level
1	0.109	Sig.	12	0.161	Sig.
2	0.105	Sig.	13	0.163	Sig.
3	0.293	Sig.	14	0.311	Sig.
4	0.421	Sig.	15	0.486	Sig.
5	0.308	Sig.	16	0.214	Sig.
6	0.443	Sig.	17	0.571	Sig.
7	0.536	Sig.	18	0.296	Sig.
8	0.121	Sig.	19	0.372	Sig.
9	0.597	Sig.	20	0.522	Sig.
10	0.409	Sig.	21	0.115	Sig.
11	0.152	Sig.			

The tabular T-value is higher than the calculated one for all items of the scale at the level of significance (0.05), so the scale has high internal consistency.

The stability of the scale: The stability of the design thinking scale was verified by the test and retest method. The reliability of the design thinking scale was extracted by applying it to a sample of (25) preparatory school students. The test was repeated after (14) days had passed since the first application, and the stability of the design thinking scale was extracted using the (Pearson) correlation coefficient, whose value was (0.87), and this indicates that the scale is stable.

Fourth: The application of the scale: After extracting the psychometric characteristics of the design thinking scale, it was applied to a sample of (250) male and female students distributed among preparatory school students for morning studies. The scale was distributed in its final form to learners in attendance in their schools. The application was completed in February and March.

Statistical methods: Statistical methods that are compatible with the objectives of the current research were used, including the following:

1. Use the Chi square equation.

2. T-test for one sample.

3. T-test for two different samples.

4. Pearson correlation coefficient.

5. Cronbach's alpha equation.

6. Percentages.

Chapter three

Study results and discussion

The result of the first objective: to identify the design thinking of preparatory school students.

The first objective indicates that preparatory school students have the ability to design thinking, and the (T) test was used for one group (Table 3).

Table (3) T-test for one group.

Variable	No.	Mean	Standard deviation	T-Test	d.f	Result

design thinking	250	84.53	12.91	2.47	249	Sig.

The tabular value of preparatory school students in design thinking is statistically significant at the level of significance (0.05), and accordingly this result is achieved that preparatory school students have the ability to design thinking and this is consistent with Arnold's theory, which indicated the ability to develop design thinking with creative work.

The second objective: to identify the differences in design thinking among preparatory school students according to the gender variable.

To verify the second objective, the researcher used the (T) test for two independent groups, and Table (4) shows the "T" test for the difference between the mean scores of males and females in the Design Thinking scale.

Table (4) T-test for the difference between the mean scores of males and females in the design thinking scale.

Variable	Gender	No.	Mean	Standard deviation	T-Test	d.f	Probability value	Result
design thinking	Male	100	94.97	13.09	2.37	248	0.437	N.S
	Female	150	92.60	13.30				

N.S: No- significant.

There were no statistically significant differences in gender between males and females on the design thinking scale. The researcher interpreted the result that the educational opportunities, the amount of training, and the curricula are the same for males and females, which made the nature of design thinking equal between males and females.

Table (5) T-test for the difference between the mean scores of the branch (scientific, literary).

Variable	Branch	No.	Mean	Standard deviation	T-Test	d.f	Probability value	Result
design thinking	Scientific	125	95.33	15.85	2.76	248	1.44	Sig.
	Literary	125	88.98	11.99				

There were differences between the sample in design thinking and in favor of the scientific branch, and the reason for this is attributed to what is required of them in the way of thinking in preparing assignments and scientific lessons that need to use thinking more than memorization and indoctrination.

Conclusions:

1. Preparatory stage students have the ability to design thinking through their answers to the design thinking scale.
2. There were no differences between males and females in design thinking, because both sexes apply to the preparatory stage based on their desires, and this means that students of both sexes have equal motivation and knowledge.
3. There were differences in design thinking among preparatory school students and according to the (scientific, literary) branch, due to the difference in the method of teaching and training between the scientific and literary branches, which has the greatest role in acquiring different experiences. The scientific branch has the ability to design thinking to encourage ideas and implement them in a practical way.

Recommendations:

1. Introducing modern teaching methods that develop design thinking in Iraqi schools.
2. The need to develop exams in the preparatory stage to develop design thinking among students.
3. Work on developing and updating educational curricula for fine arts institutes to take into account multiple methods of design thinking in order to raise the learner's competence in design thinking.

Suggestions:

The researcher suggests conducting the following studies:

1. Design thinking among intermediate and university students and finding differences between them.
2. Design thinking and its relationship to creative motivation among university students.
3. Design thinking and its relationship to the mental skills of preparatory school students.
4. Design thinking and its relationship to multiple intelligence among students of fine arts institutes.

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