

# A Proposed Educational Program Based on Project-Based Learning (PBL) for Teaching Home Economics and its Impact on Developing Creative Thinking and Problem-solving Skills of Third-grade Intermediate Female Students

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## Abstract

*This study examined the effectiveness of using project-based learning (PBL) for the teaching of home economics and determine its impact on the development of students' creative thinking and problem-solving skills. To achieve the objectives of the study, the researchers used the quasi-experimental approach. Pre- and post-intervention tests were conducted with two (experimental and control) groups of third-grade intermediate female students. Two tests were administered: one to test the students' creative thinking skills, and the other to test their problem-solving skills. The control group were taught a home economics unit by conventional teaching methods; the experimental group were taught using the PBL approach. The following materials and tools have been prepared by the researchers: a proposed educational program based on project-based learning (PBL), a test of creative thinking skills, and a test of problem-solving skills. The findings revealed that there were statistical differences (0.05) between the mean scores for the pre-PBL and post-PBL tests, indicating that PBL significantly improved the students' creative thinking and problem-solving skills. Several recommendations and suggestions are offered based on the findings.*

**Keywords:** *Projects-Based Education, Creative Thinking Skills, Problem-Solving Skills, Home Economics, Female Students*

## INTRODUCTION

The Kingdom of Saudi Arabia (KSA) has always given high priority to education since its establishment as a nation many years ago. By offering free education and recruiting consultants and teachers from around the globe, it has made great strides and significant advances in educating the Saudi population. Apart from encouraging and inspiring the young to attend schools, colleges, and universities, the Saudi government allocates a sizeable proportion of its annual budget to education. Moreover, the KSA has consistently developed and modernized its education system to adapt to changes driven by economic, social, and scientific development. To address the contemporary challenges arising from this development, the Ministry of Education, in alignment with the goals of Saudi Vision 2030, has made efforts to develop a high-quality educational system that produces teams and individuals who can help meet the Saudi community's current and future needs, overcome challenges, and contribute to the country's viable and sustainable economic and social development.

Nowadays, modern curricula in developed countries are delivered using pedagogical methods and strategies intended to produce independent learners who will be able to engage in lifelong learning. Technology can give students access to a multitude of resources, enable them to cross-check the accuracy of information, and to use it and store it as required.

PBL is one of the strategies that contribute to attaining the aforementioned objectives. It is an outstanding educational model that combines knowledge and application. At school, students learn to understand and analyse real-world problems and apply problem-solving skills to reach solutions. Al-Atawi (2015) claimed that traditional pedagogical strategies involve memorization and repetition, also known as rote learning, and are applied in the classroom and laboratory dominated by a teacher-centred approach. In the classroom, students are offered few if any opportunities for discussion and collaboration. On the other hand, PBL involves the

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active participation of students in the learning process. The learning process is student-centred, and the teacher takes the role of learning facilitator.

The PBL approach includes various effective teaching methods such as brainstorming, problem-solving, discovering learning or an inquiry-based learning method, inquiry-based learning, and joint learning, while also taking into account students' individual learning differences. According to Gardner (1993), it is crucial to recognize the learning patterns of students within each class. Teachers plan lessons to cater for each student's preferred learning method (Hussein, 2007). It has been found that PBL helps students to develop and improve their problem-solving and creative-thinking skills, in addition to communication skills, flexibility and production of original ideas.

PBL was inspired by the intelligence theory established by Gardner (1993), who revealed the importance of creating an effective learning environment by implementing certain techniques and developing a collaborative learning community. PBL is a holistic approach that seeks to immerse students fully in their learning by requiring them to seek solutions to real-world problems. Students are encouraged to ask questions, discuss ideas, make predictions, collect and analyze data, and make inferences. The purpose of project-based education is to maximize student's involvement in their own learning. Through the use of questions and discussion, students attempt to solve problems by predicting outcomes, analyzing data, and conveying their ideas and results to others (Gardner, 1993).

## **Research Problem**

Home economics is an applied science that utilizes facts and laws in various fields of knowledge and arts to create an interrelated variety of fields that concern all aspects of family life to improve the quality of life and raise the community's standard of living. In reality, the home economics curriculum in KSA schools, and the teacher-centred approach to education, requires female students to be passive learners who merely acquire information dispensed by the teacher. Most of these students show no enthusiasm for the subject and do not see its relevance to them or the need to retain the knowledge they acquire. According to the literature (AbualMagd, 2014; Kojak, 2001; Kojak & Daoud, 2005), students tend to compare home economics with subjects that they perceive as having a higher status and that are more connected with the real world. Home economics. Furthermore, by teaching this subject using traditional methods, teachers are failing to make students aware of its connection to their everyday lives as well as social and other issues. Hence, students are not developing the skills and abilities that will help them to cope with an ever-changing environment. Students are not encouraged to be creative or to develop enquiring minds. This is borne out by the findings of studies that show that modern teaching methods, including PBL, are effective teaching and learning techniques in comparison with traditional approaches (Baltan, 2017; Hassanein, 2007; Zahid, 2017; Al-Zahar, 2015; Zyoud, 2016; Al-Sayed and Ali, 2011; Al-Shariofi, 2008; Al-Sa'iri, 2010). Findings indicate that numerous female students are dissatisfied with the home economics as a theoretical subject. Because it is a theoretical subject, most teachers use indoctrination and the 'chalk and talk' approach to teach the subject. Furthermore, they rely on the textbook as the sole source of information. Several studies have found that traditional teaching methods are inadequate in meeting the current needs of students who are living in an ever-changing environment, particularly as a result of technology (Aba Al-Khail, 2011; Ahmed, 2018; Tammam, 2002; Attia, 2009).

## **The Current Study**

Given the above, and in response to the current international educational trends in the field of education which aim to equip students with personal and professional skills, the current research examines the implementation of an educational program (PBL) that meets individual learning needs and is aligned with contemporary learning requirements. These include creative thinking and problem-solving skills that can be applied to solve real-world problems. PBL is consistent with the objectives of the subject of home economics and increases female students' awareness of the importance of solving problems in a systematic way by applying the scientific method.

The five objectives of the current study are:

1. to identify the creative thinking skills necessary for intermediate third-grade female students;
2. to identify the problem-solving skills necessary for intermediate third-grade female students;
3. to develop an educational program based on project-based learning (PBL) in teaching home economics to develop the creative thinking and problem-solving skills of intermediate third-grade female students;
4. to explore the impact of an educational program based on project-based learning (PBL) to develop creative thinking skills in home economics among third-grade intermediate female students;
5. to examine the effectiveness of an educational program based on project-based learning (PBL) to develop problem-solving skills in home economics among intermediate third-grade female students.

To realize these objectives, five research questions are formulated in the context of the home economics subject being undertaken by intermediate third-grade female students.

**RQ1:** What are the creative thinking skills needed by students?

**RQ2:** What are the problem-solving skills needed by students?

**RQ3:** How can a project-based learning program help to develop students' creative thinking and problem-solving skills?

**RQ4:** What is the impact of a project-based learning program in terms of improving students' creative thinking skills?

home economics

**RQ5:** What is the effectiveness of a project-based learning program in terms of developing students' problem-solving skills?

## **Hypotheses**

This research was conducted to test two hypotheses:

1. The PBL program has a significant positive impact on students' performance on the creative thinking skills test.
2. The PBL program has a significant positive impact on students' performance on the problem-solving skills test.

## **Significance of the Study**

This study makes a significant contribution to the field of education in general and to the teaching of the home economics subject in particular.

Teachers may be encouraged to incorporate PBL in the home economics curriculum as it improves student learning and enhances the learning environment. home economics

It may raise the awareness of experts in the field of home economics regarding the importance of integrating PBL in the teaching of home economics curricula.

This study is consistent with the education goals articulated in Saudi Arabia's Vision 2030, which aims to improve the education system and its outcomes, keep up to date with current global trends in education, and support sustainability.

This study offers an effective approach to teaching a practical subject and contributes to the current literature on ways to improve teaching methods.

## LITERATURE REVIEW

### Creative Thinking Skills

The meaning of thinking is associated with human existence, and is one of the attributes that distinguishes man from another living things. Thinking is one of the cognitive processes taking place in the mind. It occurs when human beings experience difficulties or have a problem needing to be resolved. Thinking and problems are at opposite ends of a spectrum. Thinking occurs when there is a problem that one faces and wants to resolve. Hence, thinking is a comprehensive process that people employ to adapt to their environment and achieve their goals. Thinking skills are mediums that are consciously applied to deal with information and to achieve particular goals and objectives. The teaching of creative thinking and problem solving skills to female students is important as these skills will help them to make appropriate decisions based on information, as well as fostering other dimensions of thinking. (Abu Jado & Nofal, 2007; Mimar, 2006). The terms " thinking" and "encouraging to do" are contained in several verses of the Holy Quran, for example, "Thus Allah makes clear to you the verses [of revelation] that you might give thought"(The Cow:219). <http://corpus.Qur'an.com/322M>.

The English word "creativity" is derived from the Latin term "creare", "to create, make": its derivational suffixes also come from Latin. The English word "create" emerged in the fourteenth century in Chaucer's *The Parson's Tale*, to suggest sacred creation. <https://en.wikipedia.org/wiki/Creativity>

Philosophers have used the term "creativity" in a certain sense that relates to life, conceptions, etc., or is a cause of discovery, or as the reason "to find something out there" (Issa, 2010).

According to Al-Hallag (2010), Graham Wallace in 1926 identified five steps in the creative thinking process:

Preparation stage: This stage comprises the gathering of information by utilizing experience and various decisions, and then combining this information in a way that would allow aspects of the problem to be identified. The person may endeavor to solve this problem at this stage, and this may lead to a further exploration of the various components of the problem and their association with each other.

The incubation stage: In this stage, the person is not actively seeking a solution. Instead, the problem is being pondered and worked through, usually sub-consciously.

The stage of illumination: In this stage, innovative ideas are born that contribute to tackling the problem. Often, novel ideas enter one's mind, often as if there is another individual who offers them ideas. Hadley (1993) asserts that at this stage, the person becomes suddenly aware of the solution. It is a *eureka* moment.

Verification stage: This is the stage where an innovative idea is tested to ensure that it will be accepted. However, the creator should not assume that the idea or solution has been finalized. The creator must be prepared for criticism and opposition, and to modify his idea based on constructive feedback. The creator must also accept that others may have different opinions.

Al-Samiri (2006) mentioned that Louis Pasteur added another stage – effort- between the preparation stage and the incubation stage. In this stage, theories may be generated which later become practical ideas. However, there is agreement that these stages are not necessarily conducted in the sequence shown above. Some stages may overlap and the various stages that are undertaken may depend on individuals' traits and abilities. Creativity is an intricate process and some individuals are able to skip one or more stages because they already have the required skills. Furthermore, the creative thinking steps can be taught to students in order to improve their learning outcomes.

According to several psychologists, creative individuals have characteristics and abilities that influence their behaviors. These characteristics are: fluency, flexibility, the ability to discern gaps and perceive problems, and creativity of thought. To be creative, a person must have a high level of some of these traits. Al-Hizan (2002) described them as follows:

## **Fluency**

The ability of a person to produce as many ideas as possible on a topic within a specific period, using the most expressive and apt language. This person has a wide range of vocabulary, is able to categorize words into classifications, and can quickly give words in a particular form. There are various types of fluency:

Intellectual fluency: this is the rate of producing ideas within a specified time such as, for instance, stating all possible usages of a cup of tea or writing as many titles as possible that are appropriate for a story.

Verbal fluency: this is the ability to express thoughts as words, and to access information from memory quickly. A person with verbal fluency can express quickly, accurately and clearly what he or she wants to say. Verbal fluency can be tested by, for example, asking someone to write as many words as possible that begin with the letter B.

Both Shawahin and Badendi (2009) added:

Shape fluency: knowing how to create a single shape from various smaller shapes.

Fallout fluency: it is the making of a higher number of single-meaning words to as great an extent as possible at a given point in time.

Expressive fluency: this is the ability to think quickly about words that are pertinent, applicable, and connected with a unique situation and to conceive ideas in applicable and meaningful terms.

## **Flexibility**

Flexibility relates to a person's ability to change his thinking by adjusting to a current situation and accommodating it. Thus, multiple replies do not appertain to one sort to reach all potential ideas and reactions. This is in contrast to inflexibility. According to Al-Hizan (2002), there are two types of flexibility:

Spontaneous flexibility: This is the ability of a person to offer a range of solutions for a problem.

Adaptive flexibility: Here the person modifies the way a method is applied, or seeks new ways to solve a problem.

## **Originality**

The creative individual does not replicate and duplicate the ideas of others and tries to find new solutions to problems. This individual's ideas are new, unique, and interesting. Originality is the top step of the creativity stepladder. It differs from fluency and flexibility in that:

It does not refer to the number of creative ideas that the person produces as in fluency, but bit much the value and quantization of those ideas, and their being novel, and this distinguishes it from fluency.

The creative person is not averse to putting forward his own thoughts and ideas, but does not want to repeat what others do, and this is what sets originality apart from flexibility (Al-Hizan, 2002).

In his book titled *'Teaching Thinking'*, Jarwan (2007) added two new skills: 1) elaboration which is the ability to add new and varied details to an idea, or a solution to a problem or an image that will help to develop, enrich, and implement it; and 2) sensitivity to problems which is the awareness of problems, needs or weaknesses in the environment or a specific situation. Problem sensitivity determines the speed with which a problem is observed and verified.

## **Problem-solving Skills**

In education, problem-solving skills are required for all types of problems. The scientific method of logical reasoning is used, and students can collaborate with their peers to arrive at solutions, or interact with their teachers when required. The situation is not a problem if the student does not consider it, and sees the need to find an adequate solution for him because this feeling motivates and thrusts the student.

### **(a) Types of problems**

Some researchers define and categorize types of problems according to various criteria. Reitman identified five types of problems according to the degree of clarity of data and objectives. Jarwan (2007) described them in this way:

Problems where the data and objectives are identified.

Problems where data are explained, and objectives are not well-defined

Problems where objectives are definite and obvious, and their data are indefinite.

Problems that are insufficient clarity of objectives and data.

Foresight problems: these problems have a correct answer, but the procedures for moving from the current situation to the final solution are indefinite. Fittingly, it needs an imaginary effort to set an objective in order to tackle the problem.

Greeno & Simon (1988) defined four types of problems:

**Transformation problems:** Here, the data are clear enough and the requirement is quite specific, and its solution requires finding a chain of procedures or processes by examining and selecting from a category of options or potentials for responding to the problem, where the transition from initial to final solution takes into consideration any prevailing conditions.

**Arrangement problems:** All elements of the problem occur with a general requirement description. The number of choices or possibilities needs to be decreased and the elements of the problem need to be organized.

**Inductive problems:** The data contain a variety of examples or indications. A general principle or pattern in the data needs to be found. The solutions for these problems require finding an overarching principle or common structure supported by examples. Such examples encompass flowing problems and experimental objective reasoning.

**Deductive problems:** The data are subject to the formulation of hypotheses, and what is necessary is to determine whether or not a particular inference is reasonable.

Taking the aforementioned into account, and due to the variety of problem types, it is obvious that no broad classification can be created. Problems are categorized according to their specific characteristics. On such a basis, there is a problem that needs to be tackled. It is important to identify the type of problem confronting students by examining data, factors contributing to the problem, and the extent to which the problem is relevant to them, and then finding the best strategy to resolve the problem.

### **(b) Problem-Solving Strategies**

Problem-solving strategies requires a certain intellectual skill whereby person draws upon prior knowledge and experience to tackle the problem, particularly if it has not been experienced previously. It is a significant type of intellectual strategy whereby an individual draws on the skills applied in similar situations. However, problems may be different in terms of complexity and whether they require only one simple solution (Al-Zayat, 2006). An assortment of strategies can be employed to address a problem. They are:

**Attempt strategy:** With this strategy, an attempt is made to apply a specific solution to the problem. If this is unsuccessful, efforts are made repeatedly until appropriate solution to the problem is found.

**Simplification strategy:** This strategy involves transforming a complex problem into a simple one. If a problem is divided into multiple parts, it is easier for a team to understand the problem and reach a solution.

**Creative thinking strategy:** This is a strategy related to cognitive thinking, and relies on creativity to reach solutions to problems. This strategy leads to problem solving as it utilizes as many tools and approaches as

possible to solve the problem. It also relies on creating innovative ways to solve a problem (Al-Abadi, 2020; Al-Huwaidi, 2006).

### **(c) Problem-Solving Skills**

Problem-solving involves taking systematic and important steps to arrive at a logical and feasible solution to a problem. According to Nabhan (2008), these steps are:

Problem feeling: This occurs when there is an obstruction to reaching an established goal.

Identify the problem: Here the problem is stated prior to finding ways to resolve it.

Problem analysis: The components of the problem are identified. Any irrelevant elements are ignored.

Problem-related data gathering: valuable sources of relevant information are identified and data is collected.

Proposing solutions: This is done by formulating several hypotheses that may lead to an eventual solution for the problem.

Critical study of proposed solutions (reaching findings): various proposed solutions are tested and the most suitable solution, according to specific criteria, is chosen.

Al-Baroudi (2015), Shaheen, and Khattab (2016) have added the stage of creative solutions and it is done by approaching numerous unknown and potential solutions, using creative methods for instance brainstorming and harmony of novelties. The possibility of attempting to test the solution and reaping the benefits from the experience attained in novel situations.

### **(d) Project-Based Learning (PBL)**

The project-based learning strategy is neither new nor an intellectual revolution in education. As Al-Hams (2019) stated, John Dewey was one of the first to promote the idea of learning by means of practical application. In his article, *My Pedagogical Creed* (1897), Dewey maintained that the presence of the teacher in the classroom is not to inflict specific ideas on, or to create special habits in, students. The teacher is there as a member of the community who helps determine paths that should impact the student and help him respond appropriately to the effects of education. Hence, the importance of indicative and practical activities that facilitate reciprocal learning relationships.

The main objective of PBL is to stimulate students' interest in real-world problems, encourage in-depth reflection on them, and motivate students to acquire and apply problem-solving skills. The teacher assumes the role of facilitator. Work with students is focused on determining worthwhile issues to explore, designing purposeful tasks, and improving students' knowledge and social skills (Hayek, 2013).

PBL is based on a project within the curriculum, and can be implemented in a range of teaching methods, such as a micro-teaching method, an explorative approach, a survey, role-play, collaborative learning, or any modern teaching where project work is integrated in the curriculum and students interact with each other and with the teacher to complete the project. A project-based learning method or problem is addressed by the student who gains research experience while the teacher acts as the instructional guide (Zeitoun, 2007).

**Stages Of The Project-Based Educational Program** There are four milestones in the project-based learning process. Bdeir (2012) and Jaber (2005) described them in this way:

#### **Project Selection**

This step begins with the teacher, together with the students, identifying their interests, needs, and goals that can be addressed by a project, and ends with students choosing or being given projects that are the most appropriate for them.

#### **Planning**

The project steps should be clear, specific, unequivocal, and without shortcomings so that students will have no difficulty understanding the project and what it requires. are able to understand the project task

immediately. The student plays an important role in this step by participating in the project design by expressing thoughts and ideas to improve the plan.

### **Project Implementation**

In this step, the theoretical side of the project plan items is explained in practical terms. Students implement the project plan under the supervision, monitoring, and direction of the teacher, and the teacher guides the students, develops a cooperative and collaborative spirit among them, and checks that each one of the students does the required work.

### **Project Evaluation**

In the final step, the teacher assesses the project outcomes and determines what the students have achieved either individually or in teams. The teacher gives feedback to the students, pointing out their strengths, and the weaknesses that need to be addressed in future projects and assessment tasks so that students can continue to improve.

### **Project-Based Educational Program Design**

Modern pedagogy is student-focused and takes individuals' cognitive processes into account. It is intended to provide the learner with personal and academic skills that will help him to acquire life balance, enable him to solve problems, and develop creative thinking skills. Nowadays, individuals need the skills enabling them to adapt to a changing environment. One way to help students become independent learners and acquire a range of skills is by presenting them with real-life problems associated with community or the environment. One of the main strategies being applied in modern education is PBL. In order to develop a PBL program that can be integrated with the home economics curriculum, the researchers reviewed previous research (comprising Zahid, 2017; Saeed, 2016; Al-Sa'iri, 2010; Akl, 2012; Abd, 2010; Quigley, 2010) and then took the following steps:

Defined the objectives of the PBL program.

Selected a unit in the curriculum to be designed based on the project-based learning strategy and defined its objectives by asking:

What are the education standards the female students are aspiring to?

What learning goals should students achieve?

What creative thinking skills will the unit seek to develop?

What problem-solving skills will the unit seek to develop?

Developed a teacher's handbook explaining the PBL program and providing implementation guidelines.

Implemented the various stages of the project, described below.

### **Selecting The Project Topic**

This is a very important task as the project planning should take into account the abilities, learning needs, and interests of the students. A successful project is one that will sustain students' interest, motivation and engagement in their learning. To emphasize the importance of students taking some responsibility for their learning, teachers and students sign a project contract.

### **Planning**

Under supervision, students develop the project plan and discuss the activity's objectives, the information they need and the sources of that information, the skills they require to complete the project, the anticipated difficulties, and the project timeline. They plan in the work what is required in the application. Students are divided into groups, and each student is allocated one or more tasks. Each group records its PBL activities.



The role of the teacher is to give direction, suggest amendments and identify any shortcomings of the project plan that must be addressed.

### Implementation

This stage is the most interesting and appealing for students as it involves them being actively engaged in the task. This stage comprises student collaboration, maintain of flexibility, controlling the progress of work on the project, adding activities to reinforce their skills in line with their progress, and ensuring that the timeline is being adhered to, or modified if necessary. In this phase, each completed stage is evaluated because the purpose is to develop behavior and skills and not evaluate the production.

### Evaluation and Reflection

Evaluation is a continuous process as it monitors the project’s progress throughout the various aforementioned phases. Upon completion of the project, the teacher asks the student to review what she has done and some of the benefits acquired from this project. The evaluation criteria must be educational and not related to productivity standards. Then the teacher gives comprehensive feedback to students so that future assessment outcomes can be improved.

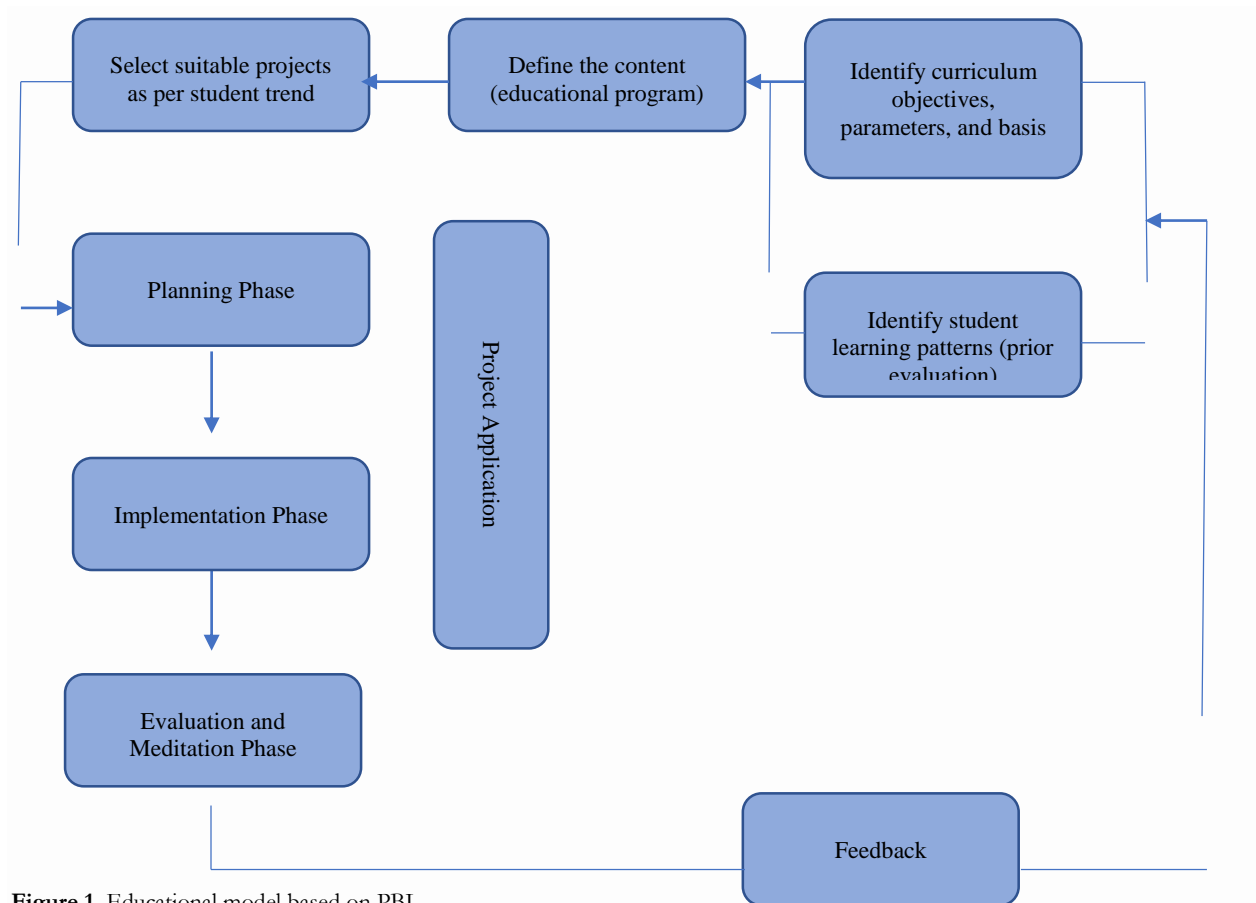


Figure 1. Educational model based on PBL

### (e) Home Economics Curriculum

Curricula are critical to the development of individuals who can think creatively, be innovative, collaborate and cooperate with others and exchange ideas in order to keep abreast of emerging knowledge and ongoing scientific progress. Moreover, the home economics curriculum seeks to produce students who can pass on and sustain family values and strengthen the Islamic culture, in addition to promoting sustainability within and outside the Muslim community.

Hence, the Saudi Ministry of Education stakeholders have acknowledged the importance of home economics courses, their development and influence on the development of family and community life, and preparing female students for their future. Al-Azuri (2011) stated that the Ministry of Education intends to prepare the female student for motherhood as well as the development of her community. Curricula are influenced by the social and technological developments of the modern era. Hence, a subject's curriculum should be aligned with students' interests and abilities as well as the goals of specific subjects such as home economics. Teaching strategies should adapt to global pedagogical trends and educational goals in order to maximize the educational outcomes of home economics (Home Economics Curriculum Document for the Primary Intermediate Stages of General Education, 1425 AH)

Hijazi, Zaki, and Al-Najjar (1997) stated that the science of home economics stems from the interest in the welfare of the family. The aim of this subject is to give students an understanding of the importance of family in order to develop the skills to strengthen this social unit which in turn builds a stronger community and ensures its prosperity and sustainability. Hence the importance of teaching this subject effectively.

### **(f) The Development of Home Economics**

Home economics was confined to two distinct areas: food and nutrition, and clothing and textiles. This is incompatible with the foundations of home economics, which must be consistently based on scientific methods (Pasha, 1993). As a science, the study of home economics has two aspects: theoretical and practical. The home economics curriculum should be based on distinct but interrelated units, and its relevance to other fields should be made evident to students.

## **METHODOLOGY**

A semi-experimental approach was adopted for this research as it is the most appropriate means of addressing a problem scientifically. In an experiment, the researcher attempts to manage all variables and principal factors (Melhem, 2006). In this research, an experimental approach involving pre- and post-measurement tests was used for two groups: a control group studying by conventional means several units prescribed in the textbook. The other was the experimental group which studied the same units using the PBL approach. The main purpose of the research was to determine whether the PBL approach influences the dependent variables: students' creative thinking skills and problem-solving skills.

### *A. Participants*

The study sample comprised 71 female students in the third intermediate grade in the sixteenth intermediate school in the General Directorate of Education in the Asir Region, for the academic year 1443H.

### *B. Study Variables*

The independent variable in this study was the PBL. The dependent variables were the creative thinking skills and problem-solving skills of female students in the abovementioned school.

### *C. Measurement Instruments*

To achieve the objectives of the research, the following two instruments were used:

- 1) A test to measure the creative thinking skills of third intermediate-grade female students.
- 2) A test to measure the problem-solving skills of third intermediate-grade female students.

### *D. Procedure*

The creative thinking skills test was prepared using the following steps:

prepare a list of creative thinking skills

identify test objectives

create a test vocabulary.

prepare the first version of the test

conduct the pilot test

determine coefficients for difficulty and ease of test items: values for the ease coefficients ranged between 0.33 and 0.40; difficulty coefficients ranged between 0.60 and 0.67, indicating that all test items were acceptable

determine discrimination coefficients: The values of the coefficients of discrimination for the test items ranged between 0.25 and 0.40, which are coefficients that indicate the degree of educationally acceptable discrimination for the test items.

establish the internal consistency of the test: All correlation coefficients between the score of each skill of creative thinking skills and the total score of the test are significant coefficients at the level of significance (0.01), indicating that the test has a high degree of internal consistency.

determine the internal validity of the test: The internal validity of the creative thinking skills test was checked by re-testing the same sample after two weeks; the value of the correlation coefficient for the test collectively was 0.767, which indicates high internal validity of the test items, calculated by the alpha method by omitting the single score. The value of the validity coefficient of the total score was 0.645, confirming that the test items measure what they are intended to measure.

prepare the final version of the test

set the test time

The problem-solving skills test was prepared using the following steps:

prepare a list of problem-solving skills

identify test objectives

create a test vocabulary.

prepare the first version of the test

determine coefficients of difficulty and ease: The values of the coefficients of difficulty ranged between (0.31, 0.47) and this shows that all test items have coefficients of ease or difficulty within an acceptable range which, according to Bloom, range between 0.20 and 0.80, indicating that all test items can be retained.

determine coefficient of discrimination: The values of the discrimination coefficients for the test items ranged between (0.56, 0.94), which demonstrates a high degree of discrimination for the test items.

determine the internal consistency of the test: All values of correlation coefficients are statistically significant at the level of significance (0.01) and therefore are relevant and acceptable and confirm that the test has a high degree of internal consistency.

Determine internal validity of the test: Two methods were followed to confirm the stability of the test. Firstly, the test was conducted a second time, and the total score for internal validity was 0.892, calculated using the Kuder & Richardson (1937), and strengthening the validity of the test results. The total value of the validity coefficient of the test was 0.906, indicating high confidence in the validity of results and the appropriateness of the test undertaken by the research sample.

prepare the final version of the test

set the test time

### **Verify the moderation of the scores of the two groups**

Since the significance levels were significantly higher than 0.05 for both tests (Kolmogorov - Smirnov) and (Shapiro Wilk), they follow the normal distribution and therefore, parametric tests (parametric) can be used to calculate the difference. In both tests, the normal distribution function (Kolmogorov - Smirnov) and (Shapiro Wilk) did not reach the limit of statistical significance at the level of 0.05 and this indicates the sample scores.

## RESULTS & DISCUSSION

The results of the tests administered to the experimental and the control groups were recorded and processed statistically using the Statistical Package for Social Sciences (SPSS). The research findings are discussed below.

### *(a) Validating H1*

H1 was tested to determine whether there was any statistically significant difference between the scores obtained for the creative thinking skills test by students in the experimental group and those in the control group. Results confirmed the hypothesis and showed that the students who learned via the PBL approach outperformed those who were taught by conventional methods in terms of creative thinking skills. The scores for each of the skills tested are given in Table 1 below.

**TABLE 1 Participants' results for the t-test (creative thinking skills)**

Skill	Group	N	Mean	Standard Deviation	Value T	Degree of Freedom	Level of significance
Fluency	Control	37	14.59	2.14	17.44	59	**0.00
	experimental	34	25.17	2.93			
Flexibility	Control	37	12.64	2.25	18.24	69	**0.00
	experimental	34	24.55	3.20			
Authenticity	Control	37	9.35	2.39	17.29	69	**0.00
	experimental	34	19	2.29			
Total score	Control	37	36.59	4.65	30.04	69	**0.00
	experimental	34	68.73	4.32			

\*\* Statistically significant at (0.01) \* Statistically significant at (0.05)

As shown in Table 1, the t. test scores ranged between 17.44-18.24 and 30.04 for the test score as a whole, which are all statistically significantly less than (0.05), which demonstrates the acceptance of that alternate hypothesis there are statistically significant differences between the female students' scores in the control and experimental groups in the post application of the test of creative thinking skills in each of (fluency, flexibility, and originality) and in the total score of the test, in favor of the experimental group, as it has the values of the major averages, and the direction of the differences always inclines to the higher average.

To determine the effect of the independent variable (the PBL) on the dependent variable (the development of creative thinking skills of students), the value of the ETA square ( $\eta^2$ ) was calculated for each specific creative thinking skill and for the overall total scores. The values of the ETA square ( $\eta^2$ ) ranged between 0.81 and 0.92, indicating that 81% - 92% of the percentage of total variation of skills in terms of the dependent variable (creative thinking skills) could be attributed to the use of PBL (independent variable) for teaching and learning, indicating that the implementation of PBL as a teaching method has a significant impact on the development of students' creative thinking skills as a whole and also in terms of the individual skills listed in Table 1. The values of the ETA square ( $\eta^2$ ) exceed 0.14, indicating the statistical differences.

From the results, it is evident that PBL contributes to the development of the creative thinking skills of female students in the third intermediate grade, and that there are statistically significant differences at the level of significance (0.05) in favor of the female students in the experimental group who were taught via PBL.

This is in each skill of creative thinking skills, and these differences are attributed to the use of the educational program based on learning projects, as indicated by the values of the ETA square ( $\eta^2$ ), which hit its total score for creative thinking skills (0.81-0.92), which means that the percentage (81%-92%) of the total variance of the total score of the sample members is due to the effect of the independent variable on the dependent variable.

The results are supported by those of previous studies (Al-Jarrah, 2018; Hamad, 2017; Al-Hawamdeh, 2018; Zubaid, 2017; Al-Shami, 2015; Al-Tarifi & Al-Khalifa, 2018; Al-anazi, 2017) that compared the impact of modern teaching strategies, as opposed to traditional teaching approaches, on the development of students' creative thinking skills.

### *Validating H2*

To verify the validity of the second hypothesis of the research, the t-test was used for the experimental and the control group to determine whether there were significance differences between the averages of the two research groups for the post-application of the problem-solving skills test. The total scores as well as the results for each test item are shown in Table 2 below.

**TABLE 2** The results of the t-test indicate the differences between the scores of the two research groups

Skill	Group	N	Mean	Standard Deviation	Value T	Degree of Freedom	Level of significance
<b>Feeling the problem</b>	Control	37	0.89	0.61	14.19	69	**0.00
	experimental	34	3.26	0.79			
<b>Determine the problem</b>	Control	34	0.86	0.63	10.84	69	**0.00
	experimental	34	2.52	0.66			
<b>Problem analysis</b>	Control	37	0.89	0.65	10.81	69	**0.00
	experimental	34	2.47	0.56			
<b>Data collection</b>	Control	37	0.78	0.71	11.18	69	**0.00
	experimental	34	2.50	0.56			
<b>Suggest solutions</b>	Control	37	1	0.97	11.51	69	**0.00
	experimental	34	3.55	0.89			
<b>Study solutions</b>	Control	37	1.08	0.82	10.40	69	**0.00
	experimental	34	3.088	0.79			
<b>Total score</b>	Control	37	5.51	1.52	27.11	69	**0.00
	experimental	34	17.41	2.14			

\*\* Statistically significant at (0.01) \* Statistically significant at (0.05)

It is clear from Table 2 that the t-test values for the skills of the test component of it range between 10.84 and 14.19, and 27.11 for the test score as a whole, which are less than the level of statistical significance (0.05). This confirms H2 which postulates that there are statistically significant differences between the scores of female students in the experimental group and those in the control group for the problem-solving skills test. As results show, the students in the experimental group performed better on this test, indicated by the overall score and the scores for each separate test item.

To determine the impact of the proposed program on the development of problem-solving skills, the value of the ETA ( $\eta^2$ ) square was calculated. The results ranged between 0.61 and 0.74 for individual skills, and 0.91 for the test as a whole. This value indicates the size of the effect of the independent variable, which means that there is a 91% of the total variation between the experimental and control groups in terms of problem-solving skills. This difference is attributed to the effect of using PBL as a teaching approach.

The results revealed that there were statistically significant differences at the significance level (0.05) in favor of the experimental group female students who were taught using the PBL program. The difference in the results obtained by the two groups indicates that teaching by means of PBL can have a positive impact on learning, particularly in terms of developing students' problem-solving skills.

The ETA square values ( $\eta^2$ ) for creative thinking skills ranged between 0.61 and 0.74 for separate skills, and were 91% for the test as a whole. Hence, 91% of the variance of the total score obtained by participants is a result of the independent variable's effect on the dependent variable. These results are aligned with those of previous studies (Ismaili, 2013; Al-Kharusiyya, 2014; Al-Deeb, 2012; Zureikat, 2018; Saeed, 2016; Abd, 2010; Miqdadi, 2017) on the effects of different teaching methods on the development of students' problem-solving skills; results show the significant academic benefit of using PBL to teach students who have different levels of skills and abilities.

## CONCLUSION

The findings of this research showed that students who were taught using the PBL approach performed better on the creative thinking and problem-solving tests than those students who did not have this intervention. As one of several student-centred teaching and learning strategies, PBL can improve these skills as well as fostering an environment of collaboration, cooperation and communication in the classroom, between students themselves and between students and teachers. Furthermore, PBL can be integrated into the curricula of all subject areas and is not restricted to home economics.

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