DOI: https://doi.org/10.33193/JALHSS.83.2022.725
ISSN online: 2414 - 3383
ISSN print: 2616- 3810
مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع
Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (83) September 2022 العدد (83) سبتمبر 2022

The Effectiveness of Task-Based Learning strategy in the Academic Achievement by Soran University Students in the Subject of Chemistry and Developing their Prospective Thinking Skills

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ABSTRACT

The research aims to investigate the impact of Task-Based Learning (TBL) strategy on the student's academic achievement and develop the prospective thinking skills of the students in the (3^{rd}) stage of the General Science Department. This research is experimental, and the research population consisted of (48) students that are randomly divided into two equivalent groups, experimental and control groups. The experimental group consisted of (24) students who were taught lessons depending on Task-Based Learning, while the control group students were taught lessons depending on the traditional method and consisted of (24) students. Two tools were prepared to identify the research aims, the first one was the academic achievement test which consisted of (25) items, and the researcher found all psychometric characteristics for the test. The second tool was the prospective thinking skills scale consisted of (40) items. The pre and post-tests were conducted and the results showed a statistically significant difference between the experimental and control groups in favor of the experimental group in academic achievement. Moreover, the students' prospective thinking skills in the experimental group developed by using the (TBL) strategy.

Keywords: Task-Based Learning, Academic Achievement, Active Learning, Prospective thinking.

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Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (83) September 2022 العدد (83) سبتمبر 2022

کاریگەری ستراتیژیەتی فێربوون لەسەر بنەمای ئەرکەوە لەسەر دەستکەوتەی خوێندنی قوتابیانی زانکۆی سۆران لە بابەتی کیمیا و گەشەپێدانی کارامەییەکانی بیرکردنەوەی داهاتوو

پوختە:

ئامانجی ئەم توێژینەوەیە نیشاندانی کاریگەری ستراتیژیەتی فێربوون لەسەر بنەمای ئەرکەوە لەسەر تێستی دەستکەوتەی خوێندن و بەرەوپێشبردنی کارامەییەکانی بیرکردنەوەی داهاتووی قوتابیان بوو.

بۆ ئەم مەبەستە توێژەر دیزاینی تاقیکاری بەکارهێناوە بۆ دوو گروپی هاوتا. کۆمەڵەی توێژینەوەکە پێکهاتووە لە قوتابیانی قۆناغی سێیەمی زانکۆی سۆران بۆ ساڵی خوێندنی (2021-2022) ، هەروەها نمونەی توێژینەوەکە لە (48) قوتابی پێکهاتووە، کە توێژەر بە شێوەیەکی هەڕەمەکی دابەشی کردوون بۆ کۆمەڵەی تاقیکاری و کۆنترۆڵکراو. کۆمەڵەی کۆنترۆڵکراو لە (24) قوتابی پێکهاتووە کە وانەکانیان وەردەگرن بە ڕێگای ئاسایی، هەروەها گروپی تاقیکاریش لە (24) قوتابی پێکهاتوون کە وانەکانیان وەردەگرن بە هۆی ستراتیژیەتی فێربوون لەسەر بنەمای ئەرکەوە (TBL). بۆ گەیشتن بە ئامانجەکانی توێژینەوەکە توێژەر (2) ئامرازی ئامادەکرد، یەکەمیان: تێستی دەستکەوتەی خوێندن بۆ بابەتی کیمیا کە پێکهاتبوو لە (25) بڕگە لەسەر شێوازی هەڵبژاردن لە چەند دانەیەك، کە گشت خاسیەتە سایکۆمەتریەکان بۆ تێستەکە دۆزرایەوە. دووەم: ئامادەکردنی پێوەری کارامەییەکانی بیرکردنەوە لە داهاتوو کە لە (40) بڕگە پێکهاتووە کە هەر بڕگەیەك (5) هەڵبژاردنی لەگەڵە. لەدوای جێبەجێکردنی ئامرازەکان و بەدەستهێنانی داتای پێویست، ئامانجەکان دەریانخست کە ستراتیژیەتی فێربوون لەسەر بنەمای ئەرکەوە(TBL) کاریگەری هەیە لەسەر تێستەکانی دەستکەوتەی خوێندن و بەرەو پێشبردنی کارامەییەکانی بیرکردنەوەی داهاتوو، کە هەردوو ئەنجامەکە لە بەرژەوەندی گروپی تاقیکاری بوون.

ووشەکانی سەرەکی: ستراتیژیەتی فێربوون لەسەر بنەمای ئەرکەوە، تێستی دەستکەوتەی خوێندن، بیرکردنەوەی داهاتوو، فێربوونی چالاك.

DOI: https://doi.org/10.33193/JALHSS.83.2022.725
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www.jalhss.com
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1. Introduction

Universities are working like a repository to detect unknown knowledge from known knowledge (bastion of concept and knowledge). Moreover, Universities are the main conducive to creating scientific community and ethical debate on contentious and challenging issues. Universities worldwide must give learners the latest information and ideas to change their thinking about life visions, make plans for more achievements, and develop at the individual and community level (Summerlee, and Murray, 2008).

In the (21st) century, the responsibility of universities is more difficult than in the last century (20th century). Because in the (21st) century there is not any space for random discussion about events and phenomena without scientific details. In addition, the fast-changing of technology is another dimension for countries to develop the higher education sector. Therefore, universities work on different approaches and implement those approaches variously to produce active learning (Halach, and Bulut, 2012).

Active learning is not a specific approach that describes steps of teaching only. It needs learners to participate actively in school and universities' activities. Active learning students have an essential role, and instructors work as facilitators. Also, it can assist and motivate students to participate in various activities in their classroom by giving a chance to all learners to discuss their ideas and opinions. One of the significant aspects of active learning is that learners must be actively working in the learning process and environment. Another part of active learning will be to try to get valuable information. On the other hand, it will aid students to retain information that they have learned. Active learning depends on student-centered approaches; one of them is the Task-Based Learning (TBL) strategy (Carr, Rodney, and Hagel, 2015; Prince, 2004).

Many researchers and experts of instruction work hard to assess the effectiveness of the Task-Based Learning (TBL) approach for the teaching and learning process. These works make the Task-Based Learning (TBL) strategy more popular. There are some reasons for the wide use of the Task-Based Learning strategy. The first reason is that educators desire to improve meaningful learning rather than rote learning and increase learners' motivation (Bonces, and Bonces, 2010). Second, improve communication skills between students because (TBL) depends on small groups (Celik, 2017). Third, participation of learners and learning process by using (TBL) strategy becomes more active than traditional strategy. Fourth, promote various skills such as decision-making skills, critical thinking, and motivate students to carefully look for information and concepts (Zhou, Huang, and Tian, 2013).

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For determination of student' learning and knowledge, teachers always apply assessment tools. There are several types of tests such as multiple-choice tests, matching- tests, true-false tests, oral tests, fill in the blank tests, short answer tests, and practical exams. Each type of these tests will be conducted for various purposes; for example, teachers can use multiple-choice tests to make a lot of questions in any chapter. Revision of this type of question does not require much time, and teachers could not differentiate between learners because teachers tend not to have any role (Kara, and Cheliklar, 2015). Oral tests are used to assess the communication skill and speaking abilities of students. To conduct Oral tests, teachers require a lot of time (Akimov, Malin, 2020).

One of the skills that students need to develop is learning to solve problems and learning to think. Thinking is an essential characteristic of humans that differentiates humans from animals. A human deal with time and spends it on better decisions to make his life more comfortable. To make the decision clearer, the thinking process must clarify conditions and evaluate all dimensions of problems by asking questions (Beyer, 2008).

Prospective thinking is a type of thinking and is a cognitive process that refers to circumstances that take place in the future. People may obtain knowledge, understand, and assess information by performing thinking processes about the future. Prospective thinking promotes the creative ability of students. Also, encourage learners to think about life in the future and achievements they want to gain. Furthermore, enhance students understanding of how to succeed in scientific life and become an inventor (Tsai, and Lin, 2016).

1. Overview:

1.1. Statement of the Problem

In recent years, educational methods have been significantly developed. An aspect that methods focus on is self-study for better achievement. Teaching chemistry relies on methods that enable students to understand theoretical lectures and laboratory experiments (Ezazi, and Nourian, 2016). So, it is vital to perform innovative strategies and avoid the traditional methods that depend on indoctrination because scientific subjects depend on thinking and finding solutions to problems. The best way to teach is rely on scientific activity. The sequence in persuading the student piece of information feels like it is discovered by this method in the experiment carried out (Ochonogor, 2011).

Through the work of the researcher as a teaching staff in the General Science Department in the faculty of education at Soran University, he noticed and compared students' grades of chemistry with other subjects. The researcher also noticed students under achievement with the subject of chemistry, their lack of

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www.jalhss.com
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interest in the material. Chemistry teachers of the material suffer from the lack of time and the difficulty in completing the course on time, due to following the traditional methods of teaching. Therefore, students are often exposed to forgetting what the teacher has explained during the lesson.

The current research problem can be framed with the following question:
(What's The Effectiveness of Task-Based Learning strategy in the Academic Achievement by Soran University Students in the Subject of Chemistry and Developing their Prospective Thinking Skills)?

1.2. Importance of Research

The Current research derives its importance from the following:

1. The results of this research may help the educational staff to use a modern strategy which will increase the effectiveness of the outputs of the educational process.
2. Teachers in chemistry may benefit from various educational courses and all educational classes with a realistic vision of the extent of students benefit from the use of task-based learning strategy.
3. To the best knowledge of the researcher, this research is the first one conducted in the Kurdistan region and Iraq which illustrates the effectiveness of the Task-Based Learning strategy in the academic achievement of Soran university students in the subject of chemistry and the development of their prospective thinking skills.
4. The research tools of prospective thinking skills scale and academic achievement are prepared by the researcher.

1.3. Aims of the Research

This research aims to:

1. Identify the effect of using Task-Based Learning on academic achievement of (3^{rd}) year students in the subject of organic Chemistry.
2. Identify the effect of using Task Based Learning strategy on the developing Prospective thinking of (3^{rd}) year students.

1.4. Research Hypotheses

1. The first null hypothesis states that "There is no statistically significant difference at the significance level (0.05) between the average scores of the students in the experimental group who were taught according to the (TBL) and the average scores of the students of the control group who were taught according to the traditional method in terms of academic achievement."

2. The first null hypothesis stated that " There is no statistically significant difference at the significance level (0.05) between the average difference between the students' scores of the experimental group who were taught

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www.jalhss.com
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according to the (TBL) Strategy and the average difference for students 'scores of the control group who were taught according to the traditional Method in terms of developing team working skills.".

1.5. Limits of the Research

This research is limited to:

1. Third-stage students in the General Science Department at Soran University.
2. Second semester of the academic year (2021-2022).
3. Educational content of Organic Chemistry (**Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons, Alcohols, Carboxylic acids, Aldehydes, and Ketones)**

1.6. Definition of Basic Terms

The following terms will be used regularly in the study according to these definitions:

1.6.1. Strategy is defined by:

- **Haji, and Aldershewi (2019):** is basic steps which are planned by teacher to achieve and reach the objectives of the lesson, so that students can perceive, understand, and apply the content of the subject of lesson.

1.6.2. Task-Based Learning is defined by:

- **Sofiana, and Mubarok, (2019)** is a strategy that promotes communication skills and is a helpful way to motivate students to carry out different tasks to provide English language proficiency.
- **The researcher defines TBL procedurally as** an educational strategy that aims to teach topics of organic chemistry at the 3rd stage in the general science department. TBL strategy is based on three steps (Pre-task, Task, and Post-task) respectively that the researcher adopted in teaching the action group to illustrate its effects on their academic achievement and prospective thinking.

1.6.3. Academic Achievement is defined by

- **Bhat, and Bhardwaj (2014)** is the measurement of developed abilities and knowledge gained in Academic topics and courses by using the result of tests that teachers conduct (Bhat, Bhardwaj, 2014).
- **The researcher defines academic achievement procedurally as:** The information and skills achieved by 3rd year students in the general science department at Soran University in organic chemistry are measured by the grades obtained by students in academic achievement tests prepared for this purpose.

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1.6.4. Prospective thinking skills are defined by

- **Al-Attar, Abu Elenein, and Al-Agha (2019)** is a skill that demonstrates creativity and criticism of each person to solve problems by using prior knowledge and integrating it with new knowledge.
- **The researcher defines it procedurally: as:** The cognitive abilities that (3rd) year students in the general science department use to enable them to anticipate the future in the light of the facts that exist in the present situation, which is measured by the degree obtained by the students on the prospective thinking scale prepared by the researcher for this purpose.

2. THEORETICAL BACKGROUND AND PREVIOUS RELATED STUDIES

First: Theoretical background

1.1. Task-Based Learning (TBL)

TBL is a student-centered approach that helps students take responsibility for their learning. Task-based learning enables learners to use their skills to understand and analyze situations or tasks. TBL was pioneered in India by Prabhu in (1979). TBL is applied in Biology, Chemistry, computer-aid learning, medical education, and language learning (Zhou, Huang, Tian, 2013, Hamad, 2017). Kavaliauskienė (2005) defined TBL as various activities that are designed for learners to use their knowledge to understand a particular situation. (Nurdiyanto, Subarkah, & Pitasari, 2015) defined TBL as a student-centered pedagogical approach that allows students to identify, manage, analyze, and solve problems.

Task-Based Learning (TBL) is an approach focused on the interaction between students and scientific resources that helps students to keep in mind what they will be doing at the end of the task. The Task-Based Learning strategy consists of three steps of pre-task, task cycle, and post-task (Asiah, Rahmet, and Lustyantie, 2021). Pre-task includes activities that instructors and learners discuss before doing the task. The second phase focuses on how and when tasks should be finished. There are several tasks like listing, sorting, classifying, comparing, etc. The last step is post-task in which students write comments about reports written during the task cycle and the results of discussion with other groups (Viriya, 2018). Task-Based Learning is a strategy used to clarify sciences and languages such as the English Language and Chemistry (Azlan, Zakaria, and Yunus, 2019).

2.1.1. The Characteristics of Peer-Led Team Learning

TBL has several features, including the following:

A. The learning process happens when interaction among learners and target concepts (Tasks) occur.
B. Allow learners to focus on both Tasks and the learning process.

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C. Improve students to contribute their experience as a significant component for classroom learning (Nunan, 2004).
D. Try to connect concepts they learn inside class with everyday life.
E. Students are motivated to think better about the desired object through the learning process (Tan, 2016).

2.1.2. Types of Tasks

Tasks in TBL have several types. (Willis, 2021) demonstrated seven types of tasks as below:

1. **Listing:** In this type of task, students work as an organizer to make a list of obtained information for the given task by the teacher as a preparation step for representing information inside the class.
2. **Ordering and sorting:** The primary purpose of this type of task is to teach students how to classify and rank the related problem information.
3. **Comparing:** Students conduct the comparison process to find and determine similarities and differences between information used for academic discussion.
4. **Problem Solving:** In this type of task, students are motivated to analyze all aspects of a specific problem to reach a suitable solution. It also enhances the ability of the students to make hypothetical solutions for future problems and situations.
5. **Creative tasks:** Students are motivated to find facts and aspects of a problem and discover new relations between concepts. Moreover, problem solutions are compared by students to select the most suitable, and students try to rank the information depending on its necessity and importance.
6. **Sharing personal experience:** Students discuss and clarify their experience of trying to find information and how they reacted with scientific resources to acquire information. Also, students describe all the points that were written about homework as a step for presenting inside the classroom.

2.1.3. Features of Tasks

Task has a lot of features illustrated by (Hismanoglu, Hismanoglu, 2011) features are:

1. The clarity of information generates more fluency and accuracy.
2. Real-world activities and tasks have a relationship
3. The completion of tasks has significance
4. The task assessment is in terms of outcome.

2.1.4. Framework of Task-Based Learning

Educational experts defined three steps of (TBL). (Solechah, 2016) has described all steps of (TBL).

1. Pre-Task: Clarifies the class's subject-related activities, words, and expressions.
2. Task-cycle: Students are allowed to utilize the language they previously have been using to finish the tasks. Subsequently, upgrade their language alongside the

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instructor's assistance when they prepare reports on their assignments. Working stroke gives the students fundamental knowledge. Working stroke has Three basics:

a) **Task:** Students can utilize the concepts they can manage and work in small groups and pairs.
b) **Planning** is the second fundamental part of the working cycle. Students make valuable reports, and teachers play the role of scientific concept mentors to expand students' learning mechanisms.
c) **Report:** This is the usual term of task routine. At this point, students notify the class about their discoveries. This term inspires the learners to improve their various skills.

3. Post-Task: It is the stage of confirming the results and performance of the tasks and the extent to which they achieve the goals. Post-task has two components:

a) **Analysis:** Students write notes during the task cycle and discuss wrong points. Teachers encourage students to have scientific debates between groups, praise learners inside the active group and give more feedback for poor activity groups.
b) **Practice:** activities depend on task features that occur in previous tasks.

1.2. Prospective thinking skills

All educational processes work to develop thinking skills. Prospective thinking (PT) is a type of thinking that depends on imagination, scenarios, planning, and prior experience. Many futuristic researchers defined future thinking with various understandings. (Torrance, 2003) defined PT as an intellectual process used to explore future experiences. Understanding and planning will develop to solve a future problem through this process. Prospective thinking is a mental activity that helps achieve some future purposes by depending on imagination, examination, expectation, and assessing their predictive ability. In addition, Prospective thinking exploration of future problems and challenges encourages us to analyze structures of problems, necessary tools to solve future problems, and evaluation of past challenges and their relation with the future (Jones et al, 2012).

1.2.1. Importance of Prospective Thinking

Researchers determined a lot of importance of prospective thinking. The following points are some of them.

1. Thinking prospectively increases positive participation to create a better future.
2. providing many future alternatives and solutions.
3. Find out future problems before happening.
4. developing self-confidence of students about their abilities.
5. A futuristic person distinguishes by accepting real-life with various conditions (Muhammad, and Gharib, 2017)

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6. It enables the learners to generate innovative ideas and discuss future problems solved at a specific time (Abu-Sufia, 2010).

1.2.2. Types of Prospective Thinking

In human cognition, Perspective thinking is a crucial aspect. Events and situations can be divided into Episodic and Semantic (Jackson, and Atance, 2008).

1. **Episodic prospective thinking (EPT):** allows a person to anticipate and re-experience an event. Moreover, (EPT) is not only thinking and imagining the future. It participates in developing individual plans that relate to the situation. (EPT) especially relates to how we choose the method that will help us remember our desired activity in the future.

2. **Semantic prospective thinking (SPT):** refers to a person's expectation of future situations and events involving other individuals. (SPT) is more general than (EPS).

1.2.3. Steps of Prospective thinking

Prospective thinking has four steps (Al-Attar, Abu Elenein, and Al-Agha, 2019):

1. **Looking around:** At that stage, the individual tries to understand and analyze the factors and everything surrounding the problem or topic.
2. **Looking ahead**: the individual sets alternatives to a problem and draws up a future scenario that can be followed in the future.
3. **Planning: a** plan is prepared to determine the gap between the current reality and the hoped-for future and develop a better scenario to achieve it.
4. **Acting**: the previous steps and expected strategies are implemented, with indicators set for evaluation, identifying strengths and weaknesses, and adjusting the course.

1.2.4. Skills of Prospective thinking

(Hafiz, 2015) classified the skills of PT into four skills. And Each skill has a few sub-skills.

1. **predicting skill:** this skill is used by someone to think about what will happen in the future. Sub-skills of predicting skill are personal choices, generating and testing hypotheses, and distinguishing between ideas.
2. **future problem solving:** is used to analyze and develop strategies to solve tough questions and complex situations that hinder progress in an aspect of life. Several sub-skills are involved in this skill such as accessing information, note-taking, establishing criteria, and evaluating evidence.
3. **speculation skill**: is the process that integrates images of future events and is affected by innovation and science fiction factors. Many sub-skills are included in this skill such as prioritizing, analyzing debates, questioning, and future induction skills.
4. **Expecting Skills:** This skill is used to predict future events depending on prior experiences.

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Second: Previous related studies:

The researchers scrutinized many previous studies related to (TBL) strategy such as the study of **Viriya (2018).** This study conducted in Thailand. This investigation aimed to determine the impact of (TBL) strategy in learners' attainment in English for academic use and their view-points regarding the (TBL) at Thammasat University. The study was experimental and its participants were (40) students of an elective language course. They have been picked based on selective sampling. Most of them were in stage two of the school of science. The survey data collection tools were reading, writing, and speaking pre and post-tests together with questionnaire. The sequel of the research showed that the reading, writing, and speaking skill of the students from English for academic purpose were strikingly higher at the (0.05) level using the TBL method and they were satiated to learn through TBL (Viriya, 2018).

Hamad (2017), This study was carried out in science section of Nasirat-Palestine. The study sought to examine the influence of Task-Based learning strategy in progress of scientific concepts along with communication skill. The tester took both experimental and illustrative perspectives. The participants of this study were (54) ninth grade learners, divided into (2) sets, control and experimental group for academic year (2016-2017). The data was collected by a written exam in form of (40) multiple choice questions together with a communication observation card with (23) elements. Pre and post-test were carried out in both groups. The outcome appeared that the experimental group has a greater average score in post-test than the control group. Moreover, they have higher marks in practicing the observation card of their communication aptitude which means TBL is a substantial tactic for students to perform better in biology and communication (Hamad, 2017).

Regarding the previous studies related to Prospective thinking Skills, the researcher searched in several studies, such as: Tsai and Lin (2016) study, this study was done in Thailand, (Kaohsiung). The main purpose pf this study was to investigate the future thinking curriculum effects on the future thinking and creativity on students in junior high school. This research is experimental. The population of this research was the ninth-grade with a total of (70) student. The experimental group consisted of (34) students and the control group consisted of (36) students. The instrument to gather data is the future thinking checklist which includes beyond reality, past review, future prediction, emotion and value, plot construction, predict change, critical thinking, and decision making. The results showed. (1) 80 % of the students felt positive for the future and thought that the curriculum could improve their plot construction, past review, and future prediction. 90 % of the students could predict the changes in the future. 60 % of the students thought that the curriculum could be helpful to predict the changes in the future and improve prospective thinking. (2) 80 % of the students could express their future life which

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ISSN online: 2414 - 3383
ISSN print: 2616- 3810
مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع
Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
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they want to achieve. More than 50 % of the students understood how to have a wonderful life and made it come true through the curriculum (Tsai and Lin, 2016).

Saeed (2021), This study was done in Egypt, (Cairo). The objective of the study is to know the effectiveness of transformational learning on developing future thinking skills. This research is experimental. The population of this study is eighth-grade. The research group is only (22) students for the academic year (2020-2021). The instruments for collecting data were a list of future thinking skills consisting of (50) items. It included (6) major skills. Pre-test and post-test were conducted. The results showed that there is a significant difference between pre-measurement and post-measurement. The mean score of post-tests was 80.45 while the mean score in pre-test was (24.9) (Saeed, 2021).

3. Methodology

3.1. Experimental Design

The researchers depended on experimental design to conduct this research and verify the research hypothesis with action and control groups. This design includes two equivalent groups in several variables (Kumar, 2011).

This study is an experimental study. The Task-Based Learning Strategy was performed with the experimental group as an independent variable and the traditional method with the control group. Pre and post-tests were conducted for the prospective thinking skills as a dependent variable and only post-test for the academic achievement, as shown in figure (3.1)

Group	Pre-test	Independent variable	Depended variable (Post-test)
Experimental	Prospective thinking skills	Task-Based Learning strategy	- Academic Achievement - Prospective thinking
Control		Usual Method	

Figure 3.1 The experimental design of the research

3.2. Research sample and Population

The research population and sample are represented by (48) students in the General Science Department in the Faculty of Education at Soran University for the academic year (2021-2022).

The researcher chose the General Science Department in the Faculty of Education at Soran University purposefully to apply the experiment as the researcher was knowledgeable about the General Science Departments who expressed willingness to cooperate with the researcher and provide the necessary facilities to conduct the research experiment.

DOI: https://doi.org/10.33193/JALHSS.83.2022.725
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The researcher visited the General Science Department. There were (2) groups of Third-stage students. The teaching methods were randomly distributed among the groups. Then, the sample was randomly selected from the groups. Group (B) was chosen to be the experimental group which included (24) students who were taught according to (TBL). Likewise, group (A) was selected as the control group which included (30) students who were taught by the traditional Method. On this basis, the total number of students selected as sample was (48) as shown in table (3.1).

Table 3. 1: The distribution of the members of the research sample over the two groups

Class	Group	Teaching Method	Number of students
A	Control	Usual Method	24
B	Experimental	Task-Based Learning	24
Total			48

3.3 Procedure of the Equivalence of the Two Research Groups

The researchers conducted the equivalence between the two research groups in several variables that affected the dependent variables and thus the results of the research and its accuracy. The method in selecting these variables was based on some previous studies and related literature, and these variables are:

1. **Chronological Age:**

The researchers calculated the students' chronological age of the two research groups in months. To confirm the equivalence of both research experimental and control groups, the researchers found the means of the age of students for both groups. The average age of students in the experimental group was (249.166) months, and for the control group, students were (250.916). To find out the significance of the difference between the two averages, the researchers used the t-test for two independent samples, so the calculated T-value was (0.630), which is less than the schedule T-value, which is (2.021) at the level of significance (0.05), and the degree of freedom (46). This result indicates no statistically significant difference exists, and thus, the two groups are equivalent in the variable of chronological age, as shown in table (3.2).

Table 3.2: The arithmetic mean, and standard deviation, the calculated and scheduled (T) values for the two groups of research in terms of the chronological age variable

Group	Number	Arithmetic	Standard	T value	Significance

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	of students	mean	deviation	Calculated	Scheduled	level (0.05)
Experimental	24	249.166	10.378	0.630	2.021	Not significant statistically
Control	24	250.916	8.811			

2. Intelligence Degree:

After applying for the test and collecting the answers of the research group students, the results showed that the arithmetic means of the intelligence degree of the experimental group students was (37.500). And The inelegancy average degree of the control group students was (36.791). To find out the significance of the difference between the two averages, the researchers used the independent T-test, and found that the difference was not statistically significant, as the calculated T-value reached (0.269) less than its schedule value of (2.021) at the level of significance (0.05) and the degree of freedom (46), and this means that the two groups were equivalent in Intelligence degree, as shown in Table (3.3).

Table 3.3: The arithmetic mean, the standard deviation, and the calculated and scheduled T- values for the two groups in the IQ test

Group	Number of students	Arithmetic mean	Standard deviation	T value		Significance level (0.05)
				Calculated	Scheduled	
Experimental	24	37.500	9.473	0.269	2.021	Not significant statistically
Control	24	36.791	8.727			

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3. Academic Achievement in General Chemistry subject of the First semester:

General chemistry was studied in the first semester of the academic year (2019-2020). The researcher could get the final grades of the students of the experimental and control groups from the Examination committee and faculty of education registration unit. The researchers used the T-test for two independent samples to compare the arithmetic mean between the research groups. The means for experimental and control groups, respectively, are equal (63.791, 59.958). The results showed that there are no statistically significant differences between research groups. The calculated T-value reached (1.953), which was less than its scheduled value of (2.02) at the significance level (0.05) and the degree of freedom (46). These details tell us the research groups were equivalent in general chemistry concept grades for the first semester, as shown in table (3.4).

Table 3.4: The arithmetic mean, the standard deviation, and the calculated and scheduled T- values for the grades of the two groups of research in General Chemistry for the First semester

Group	Number of students	Arithmetic mean	Standard deviation	T value		Significance level (0.05)
				Calculated	Scheduled	
Experimental	24	63.791	6.514	1.953	2.021	Not significant statistically
Control	24	59.958	7.074			

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4.The Overall Average Degree for Students of the two Research Groups for the 5th semester

The researcher could obtain and calculate the students' final grades for the action and control groups in the (5th) semester of the academic year (2021-2022) from the faculty of the education committee of examination. The average marks of the control and experimental groups calculated which arithmetic mean of the experimental group was (65.990) and the control group (61.595). The researchers used the independent T-test to compare research groups with each other, and the results show no statistically significant difference between them. The calculated T-value was (1.639) when the schedule value at the level of significance (0.05), a degree of freedom (46) is equal (2.021). These results tell researchers that the research groups are similar in the overall average in the (5th) semester, as shown in table (3.5).

Table 3.5: The calculated mean, standard deviation, calculated and tabulated T-values for two research groups in the overall rate

Group	Number of students	Arithmetic mean	Standard deviation	T value		Significance level (0.05)
				Calculated	Scheduled	
Experimental	24	65.990	9.621	1.639	2.021	Not significant statistically
Control	24	61.595	8.947			

5. Parents' Educational Attainment

A. Fathers

The researchers analyzed obtained data to indicate equivalence between experimental and control groups. For this purpose, the researcher used the Chi-square equation (χ2). After the treated data, the results showed that the calculated value of Chi-square (χ2) reached (1.34), and its scheduled Chi-square value in the degree of freedom (1) is equal to (3.81). When calculated Chi-square (χ2) and its schedule value are compared, there is no statistically significant difference between experimental and control groups, and research groups are equivalent, as shown in table (3.6).

Group	Number	Fathers' Educational Attainment	χ2 value	Fathers'

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Table 3.6: The educational attainment of students' fathers, the two research groups and the calculated and scheduled value of the chi-square

	of students	Primary and below	secondary	High school	Institute and higher	Calculated	Scheduled	Educational
Experimental	24	11	4	5	4	1.340	3.81	Not significant statistically
Control	24	15	4	5	0			

B. Mothers:

To determine the equivalence between experimental and control groups, the researchers used Chi-square (χ2). The results showed that the calculated Chi-square value was reached (0.10). At the same time, the schedule Chi-square (χ2) in the degree of freedom (1) and at a significant level (0.05) is equal to (3.81) when the calculated value of Chi-square (χ2) is less than the schedule value of Chi-square (χ2); this shows a statistically significant difference between research groups. The equivalence between research groups, as shown in Table (3.7).

Table 3.7: Students' mothers' educational attainment of the two research groups and the calculated and scheduled values of the chi-square

Group	Number of students	Students' Mothers' Educational Attainment				χ2 value		Significance level (0.05)
		Primary and below	secondary	High school	Institute and higher	Calculated	Scheduled	
Experimental	24	22	2	0	0	0.00	3.81	Not significance statistically
Control	24	22	2	0	0			

6. Prospective Thinking Scale:

The researcher applied a prospective thinking scale which was prepared for this purpose to the students of the experimental and control groups. The results showed that there is no statistically significant difference. As such, the two groups are equivalent in terms of this variable, as shown in table (3.8).

Table 3.8: The calculated mean, standard deviation, calculated and scheduled T-values for two research groups on the Prospective thinking scale

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Group	Number of students	Arithmetic mean	Standard deviation	T value		Significance level (0.05)
				Calculated	**Scheduled**	
Experimental	24	142.375	18.455	0.954	2.021	Not significance statistically
Control	24	146.541	10.815			

3.4 Research Tools

The researcher prepared two tools to obtain the objectives of the research: Academic Achievement in Organic chemistry and a scale for the Prospective thinking test.

3.5.1 Academic Achievement Test

A. Test Items:

The researchers prepared the test for Organic chemistry, which included (25) items of the multiple-choice type. Each item had four alternatives with instructions explaining how to answer the test.

3.6. Prospective thinking scale

Since one of the aims of the current research is to identify the impact of the use of (TBL) on the development of Prospective thinking skills, the researchers prepared a scale for team working, and prepared a preliminary version of the team working test including (40) items. Each item had five alternatives to answer according to instructions explaining the way to answer. And the researcher tested its validity and reliability.

3.7 Preparing Teaching Plans

Throughout the sixth semester and the duration of the experiment period, the researchers prepared (40) teaching plans considering the specific behavioral objectives and educational content for the two research groups. The experimental group according to the Task-Based Learning (TBL) strategy, while the control group plan has been prepared according to the traditional method.

3.8 Procedures for Applying the Experiment

After completing the requirements of the experiment, the researcher started the following procedures:

1. Begin on (21/2/2022) until (27/2/2022) in the General Science Department at Soran University. This period was assigned to verify procedures of equivalence

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between students in the experimental and control groups. Moreover, to conduct a prospective thinking pre-test and arrange the study timetable for the study with the presidency of the General Science Department.

2.The actual teaching of the research groups began on the Monday corresponding to (28/2/2022) and went on until Sunday (15/5/2022). The application continued for (10) weeks.

3.9 Applying Research Tools

1. **Academic Achievement Test:**
   The researchers conducted the Organic chemistry test for the experimental and control group students on (19/5/2022). The students were informed of the date one month before the test day.
2. **Prospective thinking Scale:**

The prospective thinking scale was conducted on the students in the research groups on (16/5/2022).

3.10 Correcting the Research Tools

After completing the research tool application, the researchers devoted themselves to correcting the answers of the students as follows:

1. **Academic Achievement Test:**
   depending on the correction key (Appendix 9), the researchers corrected the students' answers in the research groups, each student obtained (1) mark for each correct answer and (0) for each wrong answer.
2. **Prospective thinking Scale:**

The researchers corrected the students' answers on the scale and gave (5, 4, 3, 2, and 1) marks for positive alternatives (Always, Often, Sometimes, Rarely, and Never), respectively. And for the negative items, the correction is inverse. The scale range of the students between (40-200) degree.

4. DATA ANALYSIS AND DISCUSSION

4.1. First Hypothesis

The First Null Hypothesis states: "There is no statistically significant difference in the significance level (0.05) between the average grades of the students in the experimental group which was taught according to the (TBL) and the average grades of the students of the control group which was taught according to the traditional Method in terms of Academic Achievement".

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To verify the validity of this hypothesis, the arithmetic means and standard deviation were calculated to the grades of students in experimental and control groups. The arithmetic mean and standard deviation for the experimental and control groups are (17.08 and 13.58) (3.02 and 3.06), respectively. After applying for the independent t-test, the schedule T-value (2.02) was at a significant level (0.05) and the degree of freedom (46) was smaller than the calculated T-value, which is reached (3.99). This comparison between the calculated and scheduled T-value identifies the effect of the Task-Based Learning Strategy, and there is a statistically significant difference between the average score of the students' test in the experimental group and the average score of the students in the control group for the favor of the experimental group. As a result, this accepts the alternatives hypothesis and rejects the first null hypothesis as shown in table (4.1).

Table 4.1:TThe arithmetic means, the standard deviations, and the calculated and scheduled T-values for the two research groups in the Academic Achievement post-test

Group	Number of students	Arithmetic mean	Standard deviation	T value		Significance level (0.05)
				Calculated	**Scheduled**	
Experimental	24	17.083	3.020	3.986	2.021	Not significant Statistically
Control	24	13.583	3.063			

This table demonstrates students who were taught the lessons by Task-Based Learning Strategy Experimental group achieved higher grades and learned more than the students who were taught by Traditional Method (Control group) after the experiment was completed. It is identified in the student grades of the two research groups, as shown in the chart (4.1).

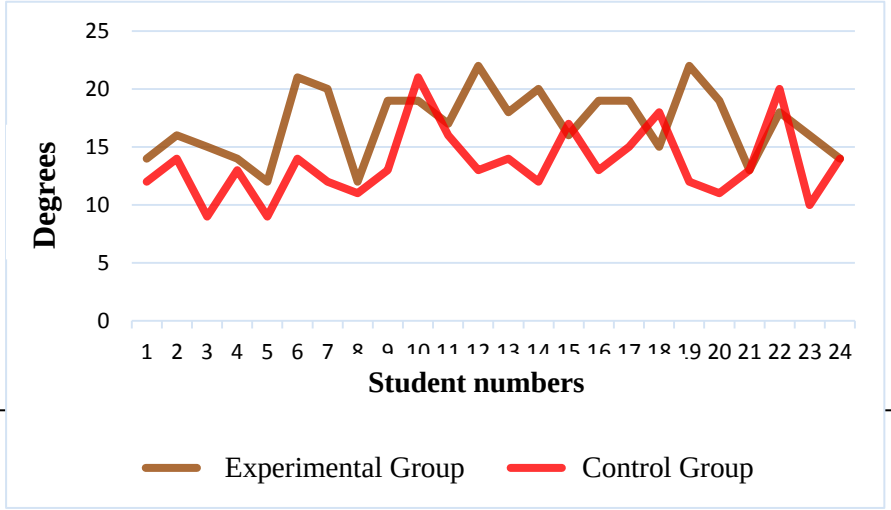

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Chart 4.1: Degrees of students in the experimental and control groups in the academic achievement test

The researcher accredited the superiority of the experimental group students over the control group students to the impact of the Task-Based Learning Strategy. Because this strategy has many features that assist students in learning the concepts and get better grades as follows:

1. When the Task-Based Learning Strategy is applied, the students could gather information and study better about details of the concepts.
2. Task-Based Learning Strategy gave a chance for the students to record added information when another classmate described concepts during the lecture.
3. The Task-Based Learning Strategy allowed students to participate actively in scientific activities and encouraged students to discover the new relationship between prior knowledge and new concepts.
4. (TBL) strategy helped the students to identify concepts easily and present subjects better.

This result of the current research agreed with the result of the following studies (Hamad, 2017), and (Viriya, 2018). The results of the above studies are in favor of the experimental group over the control group. These studies used the TBL strategy to identify the effectiveness of it on the chemistry, English skills, and Biology.

4.2. Second Hypothesis

The Second Null Hypothesis states: "There is no statistically significant difference at the significance level (0.05) between the average difference of the students' grades of the experimental group who were taught according the (TBL) and the average difference of the students' grades of the control group who were taught according to the traditional Method in developing Prospective skills".

To validate this hypothesis, the standard deviation and arithmetic mean of the student grades in both experimental and control groups find out in the pre and post-

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tests of the prospective thinking. The results showed a difference in the growth of the average variation in Prospective thinking between the experimental and control group students. To show this difference, an independent t-test for two samples was used. The results are shown in table (4.2).

Table 4.2:T-test results indicating the average variations between growth differences mean in Team working skills for both groups

Group	Number of students	Mean of differences	Standard deviation of differences	T value		Significance level (0.05)
				Calculated	Scheduled	
Experimental	24	14.833	24.924	2.207	2.021	Statistically significant
Control	24	1.625	15.446			

This table (2) demonstrates that the schedule value (2.021) at the level of significance (0.05) and the degree of freedom (46) is smaller than the calculated T-value, which is reached (2.21). This result means that there is a difference between the average degrees of the development of prospective thinking between the experimental group students and the students in the control group in favor of the students in the experimental group which in turn means that the TBL strategy has been effective in developing prospective thinking when compared with the Traditional Method. As a result, this accepts the alternatives hypothesis and rejects the second null hypothesis, as shown in the below chart (4.2)

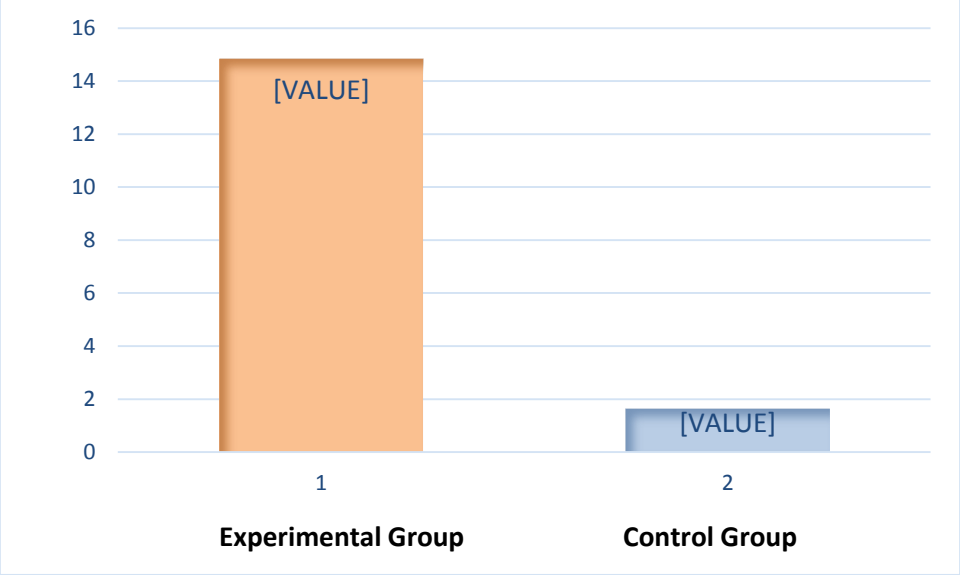

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Chart 4.2: Comparison between the average difference between the degrees of female students of the experimental group and control group in the Prospective thinking Scale.

The result of this study agrees with the result of the following studies: (Tsai, and Lin, 2016) and (Saeed, 2021). The results of these studies illustrated the proficiency in the experimental group students over the control group students in the development of prospective thinking because of using different strategies, and teaching methods to develop prospective thinking.

5. Conclusions, Recommendations and Suggestions

5.1. Conclusions

In the light of the study results, the researchers completed the study with the following conclusions**:**

1. The (TBL) strategy demonstrated that it significantly impacts the students' motivation and academic achievements. Moreover, the TBL strategy worked as a key to developing students' prospective thinking, particularly in the experimental group.
2. The students' results and activities in the experimental group showed enthusiasm for implementing the procedure and steps of the TBL strategy. The (TBL) strategy revived the students' relationship to work together for the same academic purposes.
3. Students focused on meaningful learning rather than just memorizing concepts only while applying the steps of the TBL strategy. And TBL allowed students to know them misunderstanding details and ideas.

5.2. Recommendations:

In the light of the results of the study, the researcher has recommended the following points:

1. Using Task-Based Learning in teaching chemistry subjects in the high schools and the Faculties of Basic Educations of the Kurdistan Region-Iraq because the TBL strategy has a significant impact on the outcomes of the learning process.
2. Interpolating and applying the theoretical framework and procedures of the TBL strategy in the teaching method subject in the Faculty of Educations and Basic Education in the Kurdistan Region Universities.
3. Recommending the Pedagogical Training Centers to conduct workshops and training courses for the instructors in the General Science Departments and teachers in the high schools to apply the TBL strategy in the chemistry subject.

5.3. Suggestions for Further Research:

The current research has been completed, and the researcher suggested some points for future studies:

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1. A comparative study between (TBL) strategy and Problem-Based Learning (PBL) strategy and their impact on academic achievements and prospective thinking.
2. A study on the impact of TBL strategy on developing other types of thinking such as Scientific thinking, Reflective thinking, and Reasoning thinking.
3. A comparative study between TBL strategy and Brain-Based Learning (BBL) demonstrates their impact on the current research variables.
4. Conducting a similar study in various environments and at another educational level.

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DOI: https://doi.org/10.33193/JALHSS.83.2022.725
ISSN online: 2414 - 3383
ISSN print: 2616- 3810
مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع
Journal of Arts, Literature, Humanities and Social Sciences
www.jalhss.com
Volume (83) September 2022 العدد (83) سبتمبر 2022

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