

## Acquisition of Self-learning Skills in Solving Scientific Problems by Secondary School Students

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### Abstract:

This study aimed at investigating the level to which secondary school students acquire self-learning in solving scientific problems in Tafila Governorate secondary schools. A questionnaire of 24 items using 5-point Likert scale was prepared. It was administered on a randomly clustered sample of 366 male and female students. The results of the study revealed that the level of secondary school students' acquisition of self-learning skills for solving scientific problems was moderate. Also, the results showed that there were statistically significant differences at  $\alpha \leq 0.05$  among the means of students' possession of self-learning for solving scientific problems attributed to the students' gender in favor of females. The study concluded with a package of recommendations among which is allocating financial and technical resources for supporting the effective implementation of self-learning skills.

**Keywords:** Science curriculum; Self-Regulated Learning; solving scientific classroom problems.



## مستوى امتلاك طلبة المرحلة الثانوية لمهارات التعلم الذاتي لحل المشكلات العلمية

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### ملخص:

هدفت هذه الدراسة التعرف إلى مستوى امتلاك طلبة المرحلة الثانوية في محافظة الطفيلة لمهارات التعلم الذاتي في حل المشكلات العلمية. ولتحقيق هدف الدراسة تم تطوير استبانة مكونة من 24 فقرة ذات تدرج ليكرت الخماسي. وبعد التحقق من خصائصها السيكومترية تم تطبيقها على عينة مكونة من 366 طالبًا وطالبة تم اختيارهم بالطريقة العشوائية العنقودية. وقد أظهرت النتائج أن مستوى امتلاك الطلبة لمهارات التعلم الذاتي لحل المشكلات كانت متوسطة. كما بينت النتائج وجود فروق ذات دلالة إحصائية عند مستوى ( $\alpha \leq 0.05$ ) بين المتوسطات الحسابية لامتلاك الطلبة لمهارات التعلم الذاتي لحل المشكلات تعزى لجنس الطالب ولصالح الإناث. وقد خلصت الدراسة لعدة توصيات من أبرزها: توفير مصادر مالية وتقنية لدعم التنفيذ الفعال لمهارات التعلم الذاتي.

**الكلمات المفتاحية:** التعلم المنظم ذاتيًا، المنهج العلمي، حل المشكلات الصفية العلمية.

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## **Introduction**

The recent decades have witnessed a few social, cultural and civilizational transformations emerging from the massive population explosion and the occurrence of global crises related to wars, refugees and pandemics heavily influenced education. The cost of education and the roles of the teacher and the learner were among other limitations for traditional face to face education (Penelope, 2019).

Corona (Covid 19) came to impose social, health, economic and educational restrictions to normal education. The world before Covid-19 was suffering from enormous challenges in the educational field. There were more than (334) million children out of school and about (844) million illiterate adults. 36% of those of secondary school age worldwide lack basic reading skills. The period of Corona pandemic was a great challenge to the whole teaching – learning process. Self- learning strategy played a major role in the attempt to overcome this dangerous challenge (The UNESCO, 2022).

School has become responsible for disseminating elaborated culture and encouraging the construction of continuous learning. It is understood that acting in the field of education requires students to learn the desired outcomes. However, there is no single, external formula that addresses the problem. What is known is that learning needs to be seen as an activity that students do to themselves proactively, rather than as a reaction to teaching. A major function of education is the development of lifelong learning skills. Self-learning can be a leading step in this regard (Zimmerman, 2002).

Today, teaching has changed dramatically; the learner is no longer just a repository of information and knowledge. Teaching became a tool of development and change through helping students acquire different attitudes and learning skills to enable them to achieve real growth. Thus, highlighting perception among learners became one of the education main goals (Damas, 2011).

Since solving scientific problems is one of the objectives of teaching subjects; self-learning helps students understand and realize them. The concept of a scientific problem refers to a specific problem, situation or incident that requires study and search for the relationship between the variables of this incident and the formulation of this relationship. The learner collects related clues to develop results and solutions. The scientific problem is also known as a specific question about a specific matter that raises the learner's concern and curiosity which prompts him to

search and find logical and objective explanations for this question (Xu & Como, 2006).

The mastery of self-learning skill aims at helping students to acquire the skills and habits of continuous learning to pursue their own education (Seifeen, 2011).

The call to use the self-learning method is largely related to the ideas and opinions of the people of the human tendency in the learning process, as the proponents of this doctrine. They called for the necessity of making the learning process a process centered on the learner himself (Chou, 2012).

It can be said that self-learning is the learning through which the concept and design of the learning project is directed, implemented and evaluated by the learners. This does not mean that self-learning is a highly individual learning that is always conducted in isolation, but rather that the learners can work in self-directed ways while participating in the collective work (Ezell, 2013).

The goal of education is not only the acquisition of knowledge, but also the acquisition of self-learning skills. Modern educational trends emphasize the need for educational policies to keep pace with the needs and requirements of the age. Interacting with modern variables such as electronic education, self-learning, distance education, digital education and continuous education is a must (Sweller, Ayres, and Kalyuga, 2011).

Self-learning is considered a process in which individuals take the initiative with or without the help of others. They diagnose their educational needs, formulate learning objectives, and identify human and material resources for their learning. In addition, they select and implement appropriate learning strategies and evaluate learning outcomes (Knowles, 2015).

Psychological studies emphasized the importance of the learner educating himself and giving him the opportunity to discover his own abilities and faculties (AL-Jarf, 2016).

Self-learning is one of the contemporary trends in education and it came as a result of the increasing demand for knowledge on the one hand and the weak capabilities of educational institutions , disasters and pandemics on the other hand. Rather, self-education becomes an educational requirement to incorporate the rapid changes for students to acquire continuous cognitive and technical skills (Shelf & Rima, 2016).

Self-learning includes the cognitive, metacognitive, behavioral, motivational and emotional aspects of learning. It is, therefore, an

extraordinary umbrella under which a considerable number of variables that influence learning (e.g. Self-efficacy, volition, and cognitive strategies) are studied within a comprehensive and holistic approach. For that reason, self-regulated learning has become one of the most important areas of research within educational psychology (Pandero, 2017).

Education policies which keep pace with the needs and requirements of age are the center of the new trends of modern education. New teaching methods aim to prepare and train students to efficiently coexist and adapt to the accelerating changes of the current era. Alongside with the information and technology revolution emerged the importance of establishing the culture of creativity at schools in particular, and in society at large (AL-Gasimi, 2018).

It is important that self-learning enhances lifelong learning for learners and makes them take responsibility, and strengthens their self-confidence, which contributes to raising their level of motivation towards learning. Also it takes into account individual differences among students, and effectively achieves educational productivity (Al - Rababa'a, 2020).

Self-learning is considered one of the advanced and modern learning strategies. They emerged from cognitive development in all aspects of life and led to solid break through of clear and tangible changes in the teaching-learning process. Through self-learning the learner directly interacts with teaching and learning situations in order to acquire experience, information, knowledge and skills. This enables him to educate himself and practice problem solving successively inside or outside school which leads to continuous education (AL-Saidi & AL-Tamimi, 2020).

The spirit of this age added its significant contribution to the emergence of self-learning as a teaching method which leads to continuous education. And utilizing it as a possible solution to enhance education quality (Qadour, 2021).

Students who learn problem solving skills often have a deeper understanding of causality. When children solve problems individually or in a group, they become more resilient. They learn to look at problems from a new perspective. Therefore, it makes them capable of taking more calculated risks (Marshall, 2022).

### **Study problem**

The directives of the Ministry of Education focus on the positive learner's role in the educational process. As a result of the students' low

performance in solving scientific problems in international testes (Timms), the Ministry of Education adopted some new strategic plans regarding the design of curricula enhancing the learner's involvement in self-learning, especially in solving scientific problems (The Ministry of Education, 2020). Therefore, this study attempted to realize the students' level of possessing self-learning for solving problems.

### **Study Questions**

This study tried to answer the following two questions:

1. What is the secondary school students' level of possessing self-learning skills in solving scientific problems?
2. Does the secondary school students' level of possessing self-learning skills in solving scientific problems differ according to gender?

### **Study Objectives**

This study aimed to reveal the level to which students of the secondary stage possess self-learning skills in solving scientific problems. In addition, it tries to realize whether this level differs according to students' gender.

### **Importance of Study**

The significance of the study lies in its attempt to shed light on the role of self-learning skills in the whole process of education. Solving scientific problems through self-learning was given special attention. It is hoped that the results of the study might benefit those who are concerned with teaching-learning process, mainly teachers and curriculum designers.

### **Limitations of the Study**

The study was restricted to a sample of (366) male and female students of secondary stage in Tafila Governorate, in the school year 2023-2024. The instrument of the study was a questionnaire.

### **Definition of Terms**

Self-learning is the process of gathering information, handling scientific problems, processing and retaining it without controlled direction from teachers or a fixed curriculum. It is also defined operationally by the level that the learner achieves on the applied questionnaire of this study.

### **Previous Studies**

AL-Zboun (2010) conducted a study aimed to identify the inclinations of the University of Jordan's students towards the effectiveness of using electronic learning platforms in developing their self-learning skills in

national culture course. The essential descriptive approach was used. The results showed that the inclinations of the students were in high degree. The results indicated that the electronic learning platforms are effective in developing self-learning skills. And there are no statistically significant differences in their inclinations according to gender, year of study, college and family income variables.

Al-Omari's study (2013) aimed to reveal the self-learning skills of students in Irbid, north of Jordan. The study sample consisted of (350) students. The results of the study indicated that the degree to which students possess the learning skills was moderate. There were no statistically significant differences in the possession of skills that can be attributed to gender.

Al-Omari and Al-Shanqiti (2019) conducted a study aimed to identify the level of students' possession of self-learning skills among Tiba University students. Also, it aimed to identify the differences among self-learning skills, with reference to gender and specialization, from the faculty perspective. The sample of study consisted of (150) male and female members of the faculty. The instrument of the study consisted of a list of ten self-learning skills necessary for university students. The results of the study revealed that there was an agreement in the opinions of the faculty in the degree of evaluation of nine of self-learning skills with a degree, (somewhat available) and one skill with a degree (available). It also showed that there are differences in self-learning skills in favor of females.

Regarding specialization, the results showed statistically significant differences among the means of responses of the faculty sample toward self-learning skills in favor of the female faculty.

Al-Jabali and Zakaria (2019) conducted a study aimed to identify the real student acquisition of self-learning skills. The study was applied to a random sample of (50) male and female students. The study concluded that the students' possession of scientific activities and experiences was at a moderate degree. The degree to which learners benefit from the process of computer learning in self-learning, came at a moderate degree. The students' use of libraries and benefiting from them in self-learning was also at a medium degree. In addition, the difficulties faced by learners in acquiring self-learning skills were at moderate degree.

AL-Muhairi's study (2019) aimed at revealing the effect of computerized educational software on developing reading and writing

skills using self-learning skills among the students of the University of Jordan.

The researcher built computerized educational software, an achievement test and a questionnaire to measure self-learning skills. The results showed statistically significant differences at ( $\alpha \leq 0.05$ ) in reading and writing skills in favor of the teaching method using computerized educational software through self-learning skills.

Lasfeto and Ulfa (2020) study aimed to recognize the relationship between self-learning and students' social interaction through online learning environment. Statistical associations between variables were inspected with parametric correlation. The study showed a statistically significant relationship between students' self-directed learning readiness and their social interaction. There were different social interactions among students based on their self-directed learning readiness.

Al-Juhani's study (2021) aimed to reveal the attitudes of graduate students at Taif University about the impact of self-learning on the effectiveness of distance education in light of the Corona pandemic from their point of view. The study sample consisted of 234 male and female graduate students at Taif University. The data was collected using a questionnaire for self-learning and another questionnaire for distance education. The results of the study concluded that the level of self-learning and distance education among graduate students at Taif University came to a high degree. There were statistically significant differences due to the effect of gender in self-learning and distance education, in favor of females.

Meliani, Qadour and Zerwali (2021) conducted a study to reveal the effect of using the self-learning skills on the academic achievement of students in light of the Corona virus crisis in the secondary schools of Ouargla. The descriptive approach was used. The sample of the study consisted of (50) male and female students. A questionnaire consisting of (20) items was applied. The results showed that there are statistically significant differences between the use of self-learning skills and the level of academic achievement of students in light of Covid-19 pandemic.

AL-Turiki's study (2022) aimed to identify the level of self-learning skills during distance education among secondary school students in Taif city. It also aimed to realize the differences in self-learning skills with regard to the variables of the study (gender, age, school year). The descriptive approach was used. To achieve the goal of the study a

questionnaire was developed by the researcher. The Means, the Independent T-test and Anova were used.

The results showed the availability of all dimensions of self-learning skills scale, and the scores were at a high degree. There was a significant difference among the scores attributed to gender, in favor of females. There weren't any significant differences attributed to school year.

### **Comments on Previous Studies**

Notably, there is lack of studies related to self-learning skills for solving scientific problems. This study benefited from previous studies in developing the instrument of the study and the study methodology, the descriptive approach. In addition, the previous studies helped the researcher in interpreting the results of the study. What differentiates this study is its sample and the instruments employed for data gathering.

### **Methodology**

To achieve the objectives of the study, the survey descriptive methodology was used by which a questionnaire was developed and administered to a randomly clustered sample.

### **Study Sample**

A survey questionnaire was administered on a randomly clustered sample. It consisted of 366 male and female students from different secondary schools in Tafila Governorate.

Table 1 shows the distribution of the study sample members according to the gender variable.

<b>Gender</b>	<b>Num</b>	<b>%</b>
Male	175	47.8
Female	191	52.2
<b>Sum</b>	366	100

### **Study Instrument**

To achieve the objectives of the study and to reveal the level of possession of self-learning skills among students of secondary stage in Tafila Governorate , a questionnaire of (24) items was developed with accordance to the educational literature and previous studies such as Mayala et.al (2021) and AL-Juhani (2021).

### **Instrument Validity**

To verify the validity of the instrument, it was presented to (8) specialized arbitrators from different Jordanian Universities as well as the Ministry of Education. They are asked to give their respected opinion

about the study instrument in terms of the number of items, their belonging to the aim of the study and their linguistic accuracy.

With reference to the arbitrator’s opinion, all modifications were taken into consideration. The wording of four items was modified; no deletion of items was recommended. The final version of the questionnaire consisted of (24) items. 5-point Likart scale was used (always, often, sometimes, rarely, never).

### Study Reliability

To calculate the reliability coefficient, a random sample of (30) students was taken from the population of study, excluding the study sample. The results showed that (Cronbach Alpha equation) was 0.84 and this value is suitable for this descriptive study.

### Correction of the Instrument

To judge the level of the students’ sample of the study possession of self-learning skills in solving scientific problems, equal categories method was adopted:

- 1—2.33            Low
- 2.34 —3.67    Moderate
- 3.68 —5         High

### Statistical Analysis

To answer the study questions, the following statistic methods are used: Means, Standard Deviation, (t- test) and Croncach Alpha.

### Study results and discussion

After collecting and analyzing data from the study sample, the results were as follow:

To answer question (1)which states: What is the secondary school students’ level of possessing self-learning skills in solving scientific problems? Means, standard deviations and ranks were computed, Table (2) represents the findings.

**Table 2 : Means, Standard Deviations, Ranks and Levels arranged in a descending order.**

No	Items	Mean	Standard deviation	Rank	Level
5	I take notes on important points when I learn a new science topic	3.78	0.58	1	High
2	Connect what you have learned from science to real life	3.74	0.56	2	High
7	I plan to organize the school time for science	3.72	0.23	3	High
4	I self-evaluate myself in solving the	3.71	0.76	4	High

No	Items	Mean	Standard deviation	Rank	Level
	exercises and homework that I accomplish				
1	Strive for excellence in science	3.70	0.56	5	High
6	I strive to reduce the sources of distraction that I may encounter while studying science	3.69	0.54	6	High
3	I can solve any scientific problem no matter how difficult it is	3.67	0.54	7	Moderate
10	Use the Internet for educational purposes that are useful for solving mathematical problems	3.65	0.48	8	Moderate
9	I have the ability to choose the appropriate self-learning strategy to solve scientific problems	3.61	0.64	9	Moderate
8	My friends describe me as having new and exciting ideas for solving scientific problems	3.20	0.34	10	Moderate
14	Underline the important parts when solving scientific problems	3.19	0.24	11	Moderate
12	I can connect previous scientific concepts with new knowledge	3.08	0.48	12	Moderate
13	Use a special form of coding to retain the acquired knowledge	3.06	0.87	13	Moderate
11	I wonder about the information in the science books used	3.00	0.46	14	Moderate
20	I consider myself Responsible for Identifying my weaknesses in solving scientific problems	2.96	0.45	15	Moderate
16	I feel good about being able to solve the scientific problems	2.92	0.57	16	Moderate
18	I do a self-assessment of the extent to which the goals and outcomes that were set from the start have been achieved	2.82	0.54	17	Moderate
17	I have the ability to plan and set educational goals to learn science	2.75	0.87	18	Moderate
19	I rely on myself to do homework and do extra- curricular activities	2.64	0.96	19	Moderate
15	I strive to have the skills that will help me solve the problems	2.55	0.58	20	Moderate
21	I wonder about the information in the science books they used	2.45	0.48	21	Moderate
23	I evaluate my ability to solve scientific problems before I get the correct answers from the teacher	2.33	0.48	22	Low
22	The hobbies that I practice in my spare time are related to solving scientific problems	2.28	0.67	23	Low

No	Items	Mean	Standard deviation	Rank	Level
24	I can determine my educational needs in solving scientific problems	2.20	0.86	24	Low
-	Total	3.52	0.54		Moderate

It is noted that the total mean of self-learning skills for solving the scientific problem is equal to (3.52) moderate level. The results showed that item(5) which states as "I take notes on important points when I learn a new science topic" came first and at a high level .Item (24) which states as "I can determine my educational needs in solving scientific problems" came last and at low level . This may indicate that many students are not accustomed to solving scientific problems on their own because they focus on memorizing information without using different thinking skills such as, critical thinking and brainstorming. Also, many teachers solve all scientific problems and do not leave students an opportunity for trial and error technique. Teachers rush to reach the final solution as if it were an end in itself. In addition, many teachers' routine work, such as the teaching load and the attempt to finish the curriculum prevent the teachers from trying to help the students solve scientific problems.

There might be lack of educational applications, either visual, audio or both that could contribute to the development of self-learning skills in solving scientific problems. Teachers' lack of sufficient focus on helping students discover their strengths and weaknesses, by enhancing the strengths and addressing the weaknesses. Also, the lack of training programs based on analyzing, organizing and meditating skills could add their contribution in this concern.

This study is in agreement with Al-Rababaa' (2020) study, which concluded that the student's level of possessing self-learning was average. But it differs from both Al-Turaiki (2022) and Al-Zoboun (2010) studies, which indicated that students possess a high level of self-learning skills. The students inability to evaluate their solution to the scientific problems before giving the correct answer , their inability to determine the requirements of problem solving, and the lack of practicing these skills on their free time might reflect the low level of their performance of self-learning for solving scientific problems.

It is noted that the skills that the student possesses with a high mean are related to the skills that might be easy for the students, such as making notes while the teacher is explaining. This may indicate that these skills

are easy to learn. The teacher can help the student overcome the obstacles of self-learning.

While the skills that students possess with a low mean are related to the ability to evaluate solving scientific problems and to determine educational needs. These skills require a double effort from teachers to train students on them.

To answer question (2) which states: Does the secondary school students' level of possessing self-learning skills in solving scientific problems differ according to gender? Independent (t-test) means and standard deviation were computed. Table (3) represents the findings.

**Table 3: Means, Standard Deviation and T- test for gender variable**

Gender	Num	Mean	Sd	t	Sig
Male	175	3.40	0.64	2.072	0.015
Female	191	3.56	0.48		

It is clear from the above table that there are statistically significant differences at ( $\alpha \leq 0.05$ ) in self-learning skills according to the gender variable in favor of the female study sample, with an average of (3.56). This might indicate that females are better at listening than males, have more discipline and commitment to possessing scientific knowledge. Al-Shanti (2010) indicated that females excel males in the listening skill, solving problems, jotting and making notes. In addition to the fact that females in our societies are motivated towards achievement and learning. They are more enthusiastic than males. Their competition is high to prove existence or access to a respectable social position. Xu & Como (2006) saw the superiority of females over males in the aspects of time management and maintaining self-motivation.

This study is in agreement with both Al-Juhani's study (2020) and Al-Turaiki's study (2022). The results of their studies showed that there are statistically significant differences at ( $\alpha \leq 0.05$ ) in favor of the females. This study differs from Al-Zboun's study (2020) which concluded that there are no statistically significant differences at ( $\alpha \leq 0.05$ ) that might be attributed to gender variable.

### **Recommendations:**

- Allocating sufficient resources, both financial and technical, to support the real implementation of Self-learning activities.
- Enhancing teachers' pre-service and in-service education and training.
- Special attention should be given by teachers to train students to gradually develop their techniques in solving scientific problems.

- Conducting more studies about self-learning skills for solving scientific problems among students at different age stages.

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