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The Effect of Technological Skills on Developing Problem Solving Skills: The Moderating Role of Academic Achievement

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This study examined the effect of technological skills and academic achievement on developing problem-solving skills and investigated the moderating effect of academic achievement on the effect of technological skills on developing problem-solving skills. This study's population consists of all secondary school students in the Directorate of Education in the Southern Mazar region in Jordan. 302 students' secondary school students were selected as random sampling techniques were used to conduct this study. A quantitative approach in the form of an online questionnaire-based survey was performed to achieve the objectives of the study. The software utilized for analysis was SPSS 23 and SmartPLS-3. The results indicated that technological skills have a positive and significant impact on developing problem-solving skills with scores of R2 is 0.664. In contrast, academic achievement has an insignificant effect on developing problem-solving skills with scores of R2 is 0.035. However, the academic achievement was able to strengthen the positive relationship between technological skills and developing problem-solving skills that the improved level of R2 from 0.664 to 0.677.

Keywords: academic achievement, developing problem-solving skills, technological skills, secondary schools, structural equation modeling (SEM)

INTRODUCTION

In recent years, educational studies have tended to focus on how to teach and develop thinking, which is one of the most essential tasks of the teacher in today's teaching approaches (Joshi & Sheela, 2020). Whereas the focus on problem-solving ability has become an issue worthy of investigation, students of various educational levels attain it to be able to handle practical obstacles, whether academic or life-related (Rajkumar & Nachimuthu, 2019). Because problem-solving abilities are at the top of the learning pyramid, they are extremely important in the lives of students (Pathak, 2015). As thinking strategies enable pupils to regulate their own thinking processes, it acts as the information processing model on the consideration of the individual executing his action in light of the information he gets (Rajkumar & Nachimuthu, 2019). The problem-solving strategy was associated with the American scientist and educator John Dewey,

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who laid the groundwork for its use in his book "How do we think and how do we solve problems?" The problem was defined as a perplexing situation that raises doubt and uncertainty in the educated individual (Malkawi, Alhadrami& Aljabri, 2019).

Kantowski (1983) described problem-solving as a process consisting of a set of behaviors, actions, or activities that guide an individual to a solution. Krulik and Rudnick (1989) described problem-solving as a process consisting of a series of behaviors, actions, or activities that guide an individual to a solution. The ultimate objective of educational institutions across the world is to create positive students who can use all of their intellectual talents to solve challenges in new scenarios (Malkawi et al., 2019). This requirement arose from the realization of students' failure to identify acceptable answers in new settings, and later the inability of academic graduates, especially professionals accountable for attaining societal growth and development (Bala & Shaafiu, 2016). This is because students' challenges are caused not largely by a lack of scientific understanding, but by the application of unsuitable problem-solving strategies (Joshi & Sheela, 2020). Previous research (i.e. Pathak, 2015, Rajkumar & Nachimuthu, 2019, Malkawi et al., 2019, Joshi & Sheela, 2020) on students at various levels revealed that they were unable to answer the challenges provided to them, although possessing the necessary information. The lack of identification and comprehension of the concerns was discovered after examining the pupils' responses. Driver and Bell (1986) stated that studying science necessitates the capacity to process, evaluate, and construct prior knowledge in order to provide meaning to what pupils experience or identify what they observe.

It is obvious from this that the variable of problem-solving competence is connected to the variable of academic accomplishment, which has been examined by educational scientists at various academic levels in an attempt to increase academic achievement (Pathak, 2015; Sutha & Gurudeva, 2019; Joshi & Sheela, 2020). Many researchers attempt to build mental abilities so that students may successfully address difficulties they meet, and they do so by utilizing the most advanced technical techniques available in this sector (Yeen-Ju, Mai & Selvaretnam, 2015; Ra et al., 2019; Rodrigues, Cerdeira, Machado-Taylor & Alves, 2021). The simulation of the human mind and its course of thought with the computer was the starting point (Ra et al., 2019). According to Berger (1982), the function of learning to think on a computer is not confined to teaching material, but also to teaching skills or processes that increase attention. According to this viewpoint, the use of contemporary technology in the service of education within our society's schools has become an unavoidable need, since technology has become an intrinsic component of the educational process, whether in schools or universities (Rodrigues et al., 2021). Almost no school is without access to and usage of current digital tools.

In view of the consecutive changes in the information era, educators strive to stay up with these developments through attempts and efforts to adapt the traditional learning environment provided by the instructor into a multi-source learning environment (Psycharis & Kallia, 2017; Ra et al., 2019). Given the advancement of technology and the astonishing expansion of its possibilities, utilizing it to assist the educational process, build long-term plans, and integrate it into education has become a key objective of current educational reform (Hutapea, Sinambela & Adlin, 2020). In addition, considerable development has been made in the field of current technological tools in general during the last few years. As a result of this expansion, modern technology has invaded the field of education, providing ideas for the educational process as well as solutions to many of the issues it faces (Hutapea et al., 2020; Bintoro, Zaenuri & Wardono, 2021). The scarcity of available materials, the large number of students in the classroom, the spacing of distances, and the adaptation to the minds of students who have been dominated by technology in order to facilitate the access of information to the mind in accordance with the curriculum's objectives in an enjoyable manner are the most significant of these (Hutapea et al., 2020).

Teachers play an important role in integrating technology into the classroom. They should be able to successfully use technology in the classroom (Richards, 2010; Rouf, & Mohamed, 2018). Teachers who are highly motivated utilize technology in the classroom more frequently than teachers who are lowly motivated (Uluyol & Sahin, 2016). Teachers' educational practices will be enhanced if they grasp how different technologies may be used to communicate material (Godwin-Jones, 2015).

The success of students' learning with modern technology is heavily influenced by how much teachers use it and how motivated they are to include it into the educational process (Gilakjani, 2012). Teachers who use modern technology in the classroom are so at ease and confident with it that their desire to learn more about it improves their confidence in using it (Browh, 2014). The use of modern technology in education represents a method that enhances the educational process and transforms it from an imitation stage to one of creativity, interaction, and skill development (Bintoro et al., 2021). One of the most significant components in the growth of the educational process is the use of current technology in education and the selection of the finest and most successful based on Jordan's unique educational system considerations (Malkawi et al., 2019). According to Al-Hilli (2019), it is not only important to introduce technology into education, but also to introduce technologies that will develop the education system and launch it to a superior level of advancement and progress in order to achieve many benefits, the most important of which are; improving the quality of education, taking into account the individual differences of students, training teachers on modern technologies to produce educational materials and appropriate teaching methods.

Among the sciences that have received modern technology's attention are the life sciences, which are defined as a science that studies the characteristics that distinguish humans, animals, and plants from inanimate objects, such as nutrition, growth, and reproduction, as well as the classification of living organisms, their behavior, and development (Wang, Cheng & Arntsen, 2017). This necessitates application in both theoretical and practical elements in order to reach the intended aims of this science, increase student motivation, and boost self-confidence by adapting to the technological world in which they wish to study (Psycharis & Kallia, 2017).

The use of modern technology in education is an important indicator of the success of the educational process, particularly in the secondary stage, because it is one of the most effective means of enriching the educational situation in the classroom and because it bridges the intellectual aspect and tangible reality, brings concepts and terms closer to students' minds, and connects theory and actual application (Ra et al., 2019). The field of modern technology in education is concerned with the use of tools and means in the educational process, such as developing educational software and facilitating access to information using technology, which has led to the development of some concepts related to the educational process, such as interactive teaching, which is dependent on interactive computer programs (Rodrigues et al., 2021). Expert systems, smart teaching programs, simulation programs, virtual reality, as well as online education and video conferencing, may bring interaction to a new level (Yeen-Ju et al., 2015).

According to Leelakulthanit (2018), technical skills are already essential and appear to be crucial to people's long-term pleasure. He also stated that the most significant talents for the twenty-first century are technology skills, communication, problem-solving, and critical thinking, which have a favorable impact on overall life satisfaction and performance.

Bintoro et al. (2021) investigated if there was a difference in students' mathematics education study program Universitas Muria Kudus problem-solving skills before and after ICT-based lesson studies. The findings revealed that after adopting lesson study based on information and communication technology, students' mathematical problem-solving skills are better than before. Al-Hilli (2019) examined the usage of software and technology to solve problems in mathematics in order to speed up the learning process. The findings revealed that incorporating information and communication technologies into a student's mathematical reasoning ability is beneficial. Also, the findings revealed that teaching using technology leads to the development of the student into a person with strong decision-making abilities, the ability to solve problems creatively, and the ability to think. Psycharis and Kallia (2017) examined the effect of computer programming on high school students' reasoning abilities, problem-solving abilities, and self-efficacy in Mathematics. According to the findings, students who took the "programming course" had significantly better reasoning abilities than those who did not. In addition, the self-efficacy indicator of students in the experimental group differed significantly from that of students in the control group. However, the findings did not support the premise that computer programming improves students' problem-solving abilities.

Many studies have shown that students with high levels of problem-solving skills have high academic performance achievement levels. Guven and Cabakcor (2012) examined the academic achievement of seventh-grade students on their problem-solving skills. The result showed that there is a high correlation between academic achievement and problem-solving skills. Pathak (2015) found that academic achievement, reasoning ability, creativity, and intelligence are all with a significant relationship with problem-solving skills. As a result, we must build the problem-solving skills of students via adequate education and training. Bala and Shaafiu (2016) mentioned that there is a positive relationship between academic achievement and problem-solving skills.

Raeisoon et al. (2018) determined the relationship between problem-solving skills and academic achievement of students at Birjand University of Medical Sciences. The results revealed that there is a positive relationship between academic achievement and the problem-solving skills of students. Given the link between students' problem-solving abilities and their academic performance, teachers should put students in situations where they can solve issues rather than pushing them to memorize things by rote so that they may see themselves in the actual world and encounter and solve problems. Fitriani (2020) examined the relationship between academic achievement and critical thinking skills through the use of a problem-based learning-predict observe explain (PBLPOE) learning paradigm in Biology. The results revealed that the academic achievement of students may improve as the critical thinking of students increases. As a result, in order to increase students' academic success, teachers should develop critical thinking abilities in the classroom.

Scholars have consistently confirmed the relation of academic achievement in problem-solving (Guven & Cabakcor, 2012; Pathak, 2015; Bala & Shaafiu, 2016; Raeisoon et al., 2018; Fitriani, 2020). According to the researches, the strength of the relationship between technological skills and problem-solving skills would be intensified as achievement academic increased. Nevertheless, there have been limited studies investigating the moderating role of achievement academic on the relationships between technological skills and problem-solving skills.

As a result, the current study is seen to be important for academics since it sheds insight on the influence of technology abilities and academic accomplishment on developing problem-solving skills. This study also looked at the moderating effect of academic accomplishment on the influence of technical capabilities on improving problem-solving abilities.

Research Objectives

This study seeks to achieve the below objectives:

1) Examine the effect of technological skills on developing problem-solving skills.

2) Examine the effect of academic achievement on developing problem-solving skills.

3) Examine the moderating effect of academic achievement on the effect of technological skills on developing problem-solving skills.

Research Questions

The current research is accomplished to answer the following research questions:

1) What is the impact of technological skills on developing problem-solving skills?

2) What is the impact of academic achievement on developing problem-solving skills?

3) Does the achievement academic moderates the association between technological skills and problem-solving skills?

Research model

This study investigated the relationship between technological skills, achievement academic and problem-solving skills. Also, this study investigated how achievement academic moderates the relationship between technological skills and problem-solving skills. Figure 1 shows the representation of this model. Figure 1 shows the research model.

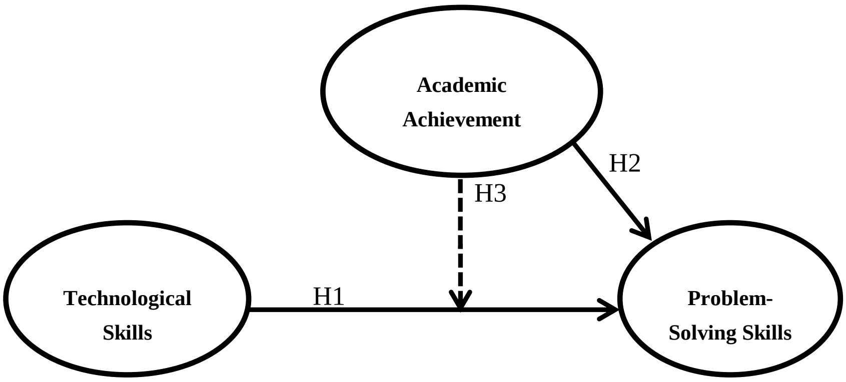

Figure 1
Research model

METHOD

Population and Sample

The population of this study consists of all students in secondary schools in the Directorate of Education in the Southern Mazar region in jordan. According to the statistics of the Ministry of Education, the number of students during the first semester of the academic year 2020/2021 reached approximately 2,457 students. According to Morgan (1970), 335 students' secondary school students from the Southern Mazar were selected as random sampling techniques were used to conduct this study. Students were given 335 questionnaires to complete. The respondents completed 323 questionnaires, which were returned to the researchers. 21 of the 323 questionnaires were found incomplete and were not utilized in the data analysis.

Research design and data collection

Quantitative approach in the form of an online questionnaire-based survey was performed to achieve the objectives of study. There were three primary components to the instrument. The first section detailed the characteristics of the respondents. In this section, the students determine their gender as well as their academic achievement. The second component is about technological skill variable. Using a five-point Likert scale, this section contains 23 positive items which were adopted from Ahmad (2019). The last section, which contains 26 positive items, elicits students' perceptions of the problem-solving skills variable, using a five-point Likert scale that was adopted from Sedeqah (2018).

Data Analysis

For descriptive analysis, the Statistical Package for the Social Sciences (SPSS) was utilized, and for a casual modeling approach, Smart PLS (partial least squares) was employed to evaluate the measurement of the inner model and the structural model. Structural Equation Modeling (SEM) is a popular second-generation multivariate statistical approach for estimating a series of unintentional inter-relationships between numerous dependent and independent constructs represented by various indicators (Gefen et al., 2000). In general, there are two ways to SEM: one is covariance-based SEM (CB-SEM), and the other is variance-based or component-based SEM, also known as partial least square SEM (PLS-SEM). CB-SEM is a theory-driven technique that uses maximum likelihood estimation to compute the parameters (Vinzi et al., 2010). Its primary goal is to replicate the theoretical covariance matrix while ignoring explained variance (Hair et al., 2012).

On the other hand, PLS-SEM is a soft modeling SEM technique was created by Wold (1982). It becomes a viable option because it needs fewer assumptions than CB-SEM. Using PLS-SEM method, the impact of the moderating effect variable on the connection between independent and dependent variable was assessed.

FINDINGS

Table 1 shows the descriptive statistics of respondents' gender and academic achievement. With reference to Table 1, taking into consideration the gender of students, The majority of respondents are female with 62.9% and 37.1% of respondents were male. With regard to academic achievement, 41.4% of the respondents had academic achievement between 71-80 grade, followed by the academic achievement group between 81-90 grade with 27.8% and between 61-70 grade with 20.2%, followed by the academic achievement group between 50-60 grade with 7.0%, while the lowest number of respondents were the group between 91-100 grade with 3.6%.

Table 1
Descriptive statistics of respondents

Variables	Category	N	%
Gender	Male	112	37.1
	Female	190	62.9
Academic Achievement	50-60	21	7.0
	61-70	61	20.0
	71-80	125	41.4
	81-90	84	27.8
	91-100	11	3.6

The Reflective Measurement Model

In order to guarantee the validity and reliability of the analytic method, the PLS-SEM approach was utilized to evaluate the measurement's goodness. The current study examined discriminant validity, convergent validity, internal consistency reliability, and indicator reliability before putting the model's assumptions to the test, as suggested by Henseler et al. (2009), Hair et al. (2011), and Hair et al. (2014).

Indicator Reliability

The indicator's reliability was evaluated by measuring the construction with the outside loadings of each measurement, where the product loading factor must be more than 0.70 (Hair et al., 2011; Valerie, 2012; Hair et al., 2014). Following these rules, three items out of 50 were eliminated since their loadings were less than the minimum value of 0.70: B23 (0.329), B25 (0.652), and B26 (0.119). Table 2 shows that 47 items were kept for further examination since their loadings were greater than 0.70.

Internal Consistency Reliability

The most common metrics used to measure the reliability of internal consistency in research are Cronbach's alpha and Composite Reliability (CR) (Peterson & Kim, 2013). Cronbach's alpha is strongly dependent on the number of items in the test, thus it tends to overestimate the measurement's reliability within internal consistency. As a result, it may be used as a conservative method for determining the consistency of internal data (Hair et al., 2014). Cronbach's alpha values for all constructs varied from 0.879 to 0.897 in this study, as shown in Table 2. The CR values for all of the structures were higher than 0.70, which was judged acceptable; they varied from 0.799 to 0.891. As a consequence, it's fair to assume that the measures' internal consistency has been checked and validated.

Convergent Validity

Hair et al. (2014) proposed checking for convergent validity at the construct level using the Average Variance Extracted (AVE), which is a frequently utilized technique. The AVE of each latent concept should be greater than 0.50 to provide acceptable convergent validity (Hair et al., 2011; Valerie, 2012; Hair et al., 2014). Table 2 indicates that all of the AVE values in this study are within the permitted range of 0.672 to 0.683; as a result, convergent validity appears to be accepted.

Discriminant Validity

As recommended by Hair et al. (2014), the current study employed product cross-loadings and Fornell-Larcker criteria to test discriminating validity. To assess the cross-loading of the indicators, the outer loading of items on the relevant construct should be higher than all of its loadings on other constructs. In other words, each item must load higher on the construct being measured and lower on the others (i.e. the cross-loads). The loadings for all of the items are higher than the cross-loads, as shown in Table 3, demonstrating discriminating validity.

To establish discriminant validity in the Fornell-Larcker test, the square root of AVE values should be compared to each latent construct's correlations. In other words, each latent construct's square root AVE should be larger than its absolute correlation with any other latent construct. This criterion is thought to be a more conservative method of evaluating discriminant validity (Hair et al., 2014). The square roots of the AVE values all exceeded the latent concept correlations, as shown in Table 4, demonstrating the discriminating validity of this study.

Table 2
Results summary of reflective measurement model

Construct	Items	Loadings	ALPHA	CR	AVE
T.S*	A1	0.807			0.672
	A2	0.797			
	A3	0.826			
	A4	0.758			
	A5	0.842			
	A6	0.829			
	A7	0.850			
	A8	0.826			
	A9	0.821			
	A10	0.832			
	A11	0.837			
	A12	0.843	0.897	0.799	
	A13	0.843			
	A14	0.811			
	A15	0.814			
	A16	0.808			
	A17	0.811			
	A18	0.830			
	A19	0.796			
	A20	0.826			
	A21	0.792			
	A22	0.819			
	A23	0.830			
P.S.S*	B1	0.851		0.891	0.683
	B2	0.851			
	B3	0.886			
	B4	0.852			
	B5	0.885			
	B6	0.881			
	B7	0.894			
	B8	0.884			
	B9	0.883			
	B10	0.876			
	B11	0.876			
	B12	0.885	0.879		
	B13	0.882			
	B14	0.886			
	B15	0.866			
	B16	0.880			
	B17	0.869			
	B18	0.884			
	B19	0.853			
	B20	0.890			
	B21	0.861			
	B22	0.872			
	B23	0.878			
A.A*	A.A	1.00	1.00	1.00	1.00

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

Table 3
Factor analysis and item loading

Construct	Items	T.S	P.S.A	A.A
T.S	A1	0.807	0.518	-0.040
	A2	0.797	0.554	0.001
	A3	0.826	0.521	-0.038
	A4	0.758	0.534	-0.014
	A5	0.842	0.524	-0.032
	A6	0.829	0.524	-0.019
	A7	0.850	0.540	-0.043
	A8	0.826	0.526	-0.020
	A9	0.821	0.546	-0.016
	A10	0.832	0.533	-0.040
	A11	0.837	0.557	-0.008
	A12	0.843	0.531	-0.035
	A13	0.843	0.610	-0.014
	A14	0.811	0.540	-0.060
	A15	0.814	0.555	-0.016
	A16	0.808	0.520	-0.059
	A17	0.811	0.571	-0.024
	A18	0.830	0.559	-0.044
	A19	0.796	0.557	0.005
	A20	0.826	0.524	-0.052
	A21	0.792	0.540	-0.022
	A22	0.819	0.544	-0.065
	A23	0.830	0.557	-0.030
P.S.A	B1	0.023	0.851	0.297
	B2	0.012	0.851	0.245
	B3	0.006	0.886	0.256
	B4	0.005	0.852	0.261
	B5	0.046	0.885	0.278
	B6	0.007	0.881	0.367
	B7	0.036	0.894	0.292
	B8	0.023	0.884	0.293
	B9	0.007	0.883	0.721
	B10	0.003	0.876	0.896
	B11	-0.003	0.876	0.861
	B12	0.039	0.885	0.910
	B13	-0.003	0.882	0.863
	B14	0.030	0.886	0.573
	B15	0.000	0.866	0.597
	B16	-0.006	0.880	0.572
	B17	-0.019	0.869	0.253
	B18	0.008	0.884	0.594
	B19	0.021	0.853	0.278
	B20	0.003	0.890	0.247
	B21	0.002	0.861	0.303
	B22	0.001	0.872	0.324
	B23	-0.007	0.878	0.289
A.A	A.A	-0.036	0.011	1.00

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

Table 4
Correlation and discriminant validity

	A.A	P.S.S	T.S
A.A	1.00		
P.S.S	0.011	0.826	
T.S	-0.036	0.663	0.820

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

Structural Model Evaluation

The following phase in the PLS route modeling study was to test the structural model (inner model) after assessing and analyzing the measurement model. As advised by Henseler et al. (2009), Urbach and Ahlemann (2010), Hair et al. (2012), and Hair et al. (2014), various requirements must be assessed, including the (R2) values, impact size (f2), and predictive relevance of the model. Finally, bootstrapping was performed to determine the significance level of the predicted relationship in the research model.

R-square (R^2)

The R^2 criteria is considered a fundamental requirement for evaluating the structural model in PLS-SEM (Hair et al, 2011; Hair et al., 2012). The R-square value represents the amount of variance in the dependent variable that can be explained by one or more predictor variables (Hair et al., 2010). According to Hair et al. (2014), there is no universally accepted R^2 level value since it is dependent on the study environment and model complexity. As a result, various criteria have been proposed to be utilized when evaluating R^2 levels. According to Chin (1998), R^2 values of 0.67 or above are significant, 0.33 is moderate, and 0.19 is weak. R^2 values of 0.75, 0.50, and 0.25, respectively, might be regarded as high, moderate and weak (Hair et al., 2014).

Figure 2 shows that the research model explains 44.1% of the overall variance in problem-solving skills based on the R-square values of the endogenous latent variable (i.e., problem-solving skills). This means that the two sets of the exogenous latent variables (technology skills and academic achievement) together account for 44.1% of the variance in problem-solving skills. According to the criteria of Chin (1998) and Hair et al. (2014), the endogenous latent variable in this study had acceptable levels of R-square values.

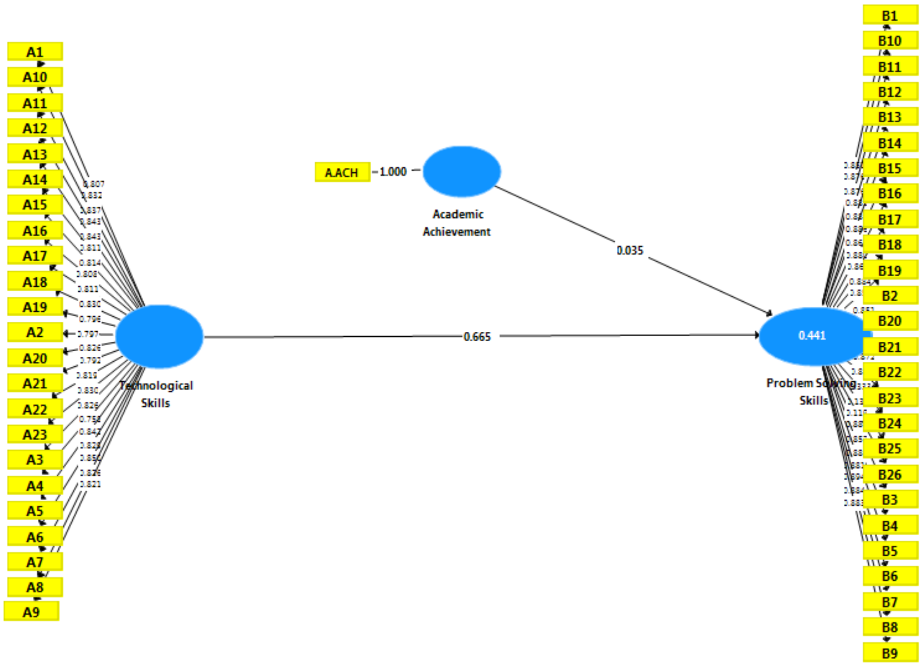

Figure 2
Items loading, path coefficient and R^2 value

Assessment of the Effect Size (f2)

According to Chin (1998), Influence size (f2) describes the effect of the independent variable (IV) on the dependent variable (DV) by mean changes in the (R^2). The impact size for technological skills on problem-solving skills was 0.789, as shown in Table 5. As a result, the effect sizes calculated using Cohen's (1988) rule on criterion variables can be considered high. Table 5 also reveals that academic achievement has a 0.02 impact size on problem-solving skills. Similarly, based on Cohen's (1988) guidelines, the results suggest that the effect sizes of this exogenous variable on the endogenous variable are small. It's worth noting that a low f^2 doesn't always imply a big effect. It just displays how each independent variable contributes to the amount of R^2 value.

Table 5
Effect size (F2)

Relationship	F^2 Value	Size
T.S $\rightarrow$ P.S.S	0.789	Large
A.A $\rightarrow$ P.S.S	0.020	Small

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

Predictive Relevance of the Model (Q^2)

The Stone-Geisser blindfolding technique was used in this study to test the model's predictive relevance (Q-square) (Geisser, 1974). Only the endogenous latent variable with a reflecting measurement model operationalization undergoes the blindfolding method (Sattler, Völckner, Riediger , Ringle, 2010). In this study, Q^2 was determined utilizing the blindfolding method with a 7-omission distance (Tenenhaus, Vinzi, Chatelin, , Lauro, 2005). When an endogenous construct's Q^2 value for a dependent latent variable is greater than zero, the explanatory latent variable is predictive (Chin, 1988). Hair et al. (2014) established three (3) evaluation criteria for Q^2. A Q^2 score of 0.35 indicates that the model is highly predictive; a Q^2 value of 0.15 indicates that the model is moderately predictive. A Q^2 score of 0.02, on the other hand, suggests that the model has small predictive significance for a particular endogenous variable. The findings of the Q^2 test for endogenous variable, which is above zero for problem-solving skills (Q^2=0.298) in the column labeled 1-SSE/SSO, are displayed in Table 6, demonstrating the relevance of the prediction model.

Table 6
Predictive relevance of the model

Construct	SSO	SSE	Q^2 (=1-SSE/SSO)
Problem-Solving Skills	7852.000	5508.599	0.298

Hypotheses of the Direct Effects

This study used a systemic model analysis to get insight into the data and evaluate the hypotheses. The PLS-SEM technique was used to evaluate the magnitude of the path coefficients, and the PLS-SEM bootstrapping procedure was used to investigate the significance of the association (see Figure 3 below).

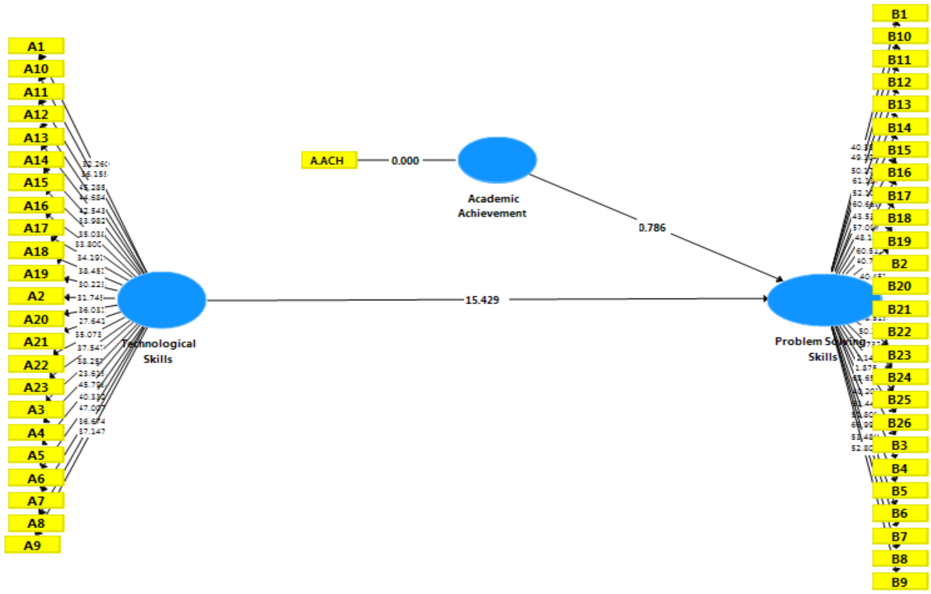

Figure 3
Direct effects

Figure 3 shows the route coefficient of the dependent and independent variables using the PLS-SEM method and the bootstrapping approach. The findings showed that one of the exogenous variables is significant and positive for the endogenous variables, whereas the other is insignificant. The path coefficients, p-values, and confidence intervals are also shown in Table 7.

Table 7
Results of hypotheses testing (Direct Relationships)

Relationships	Std. Beta	Std. Error	t-values	p-values	Confidence Intervals CIs		Decision
					LLCI	ULCI	
T.S⟶ P.S.S	0.665	0.043	15.429	0.000	-0.050	0.122	Supported
A.A⟶ P.S.S	0.035	0.044	0.786	0.422	0.575	0.746	Not Supported

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

From Table 7 and Figure 3, two direct relationships were examined. One was significant at the 1% significant level, and one was not significant, i.e., technological skills had a significant and a positive relationship with problem-solving skills (p-value = 0.000, t-value = 15.429 and β = 0.665). Therefore, the hypothesis H1was supported. On the other hand, academic achievement had insignificant relationship with problem-solving skills (p-value = 0.422, t-value = 0.782 and β = 0.035). Therefore, hypothesis H2 was not supported.

Testing for Moderation

The relationship between technological skills academic achievement and problem-solving skills (β=0.677; t=16.356; p<0.000). Hence, it is concluded that technological skills have a positive influence on problem-solving skills and the level of R^2 that is accounted for the model improves from 0.664 to 0.677 (see Figure 4 below).

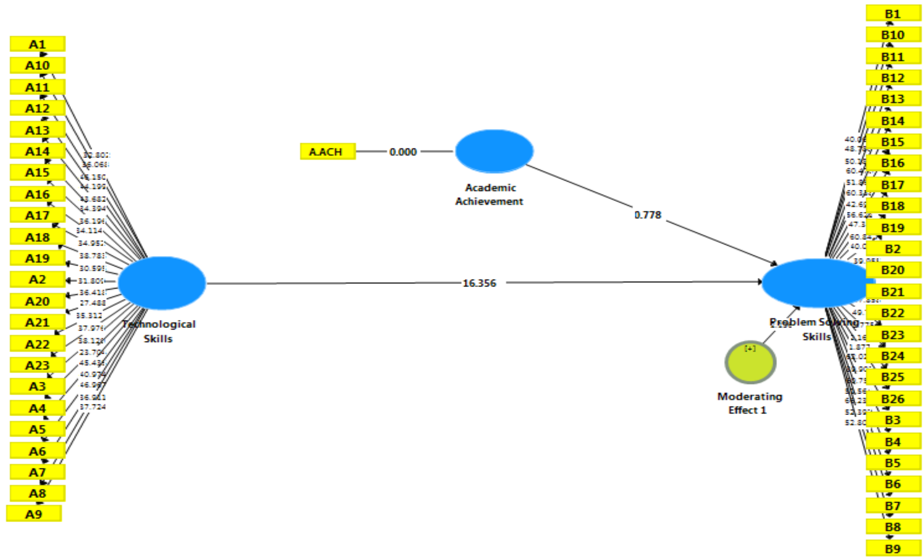

Figure 4
Moderating effects

Table 8 shows, there is a significant addition of the R^2 level that remains at 0.677. The interaction term was found to be statistically significant as shown in Table 8. The current results indicate that the interaction term of technological skills*academic achievement is significant (β=0.677; t=16.356; p<0.000); hence, H3 is supported.

Table 8
Moderating testing

Hypothesized Path	Std. Beta	Std. Error	t-values	p-values	Decision
T.S*A.A ⟶ P.S.S	0.677	0.041	16.356	0.000	Supported

Note: T.S= Technological Skills, P.S.S= Problem Solving Skills, A.A= Academic Achievement

DISCUSSION

The effect of technological skills on developing problem-solving skills

Technological skills had a significant and a positive relationship with problem-solving skills (p-value = 0.000, t-value = 15.429 and β = 0.665). Therefore, the hypothesis H1was supported. Teachers tend to adopt technological skills to present lessons in an attempt to develop the problem-solving skills of students. Technological skills consist of programs, smartphones, tablets, data shows and smart boards for which there is a significant function overseeing by teachers to their development, implementation, and ongoing administration. The findings of this study disclosed a significant and positive relationship between technological skills and the problem-solving skills of students. A possible reason for this may be attributed to the finding that the use of technological skills helps students acquire relevant problem-solving skills to carry out their work to determine problems clearly. Students should be trained on the necessary technological skills, which also enhance their understanding of the importance of finding several solutions to problems. This is in line with the study by Psycharis and Kallia (2017), Al-Hilli (2019), Bintoro et al. (2021) that adequate technological skills intervention can help to improve the problem-solving skills of students because students are knowledgeable and skillful in handling problem-solving at schools.

The effect of academic achievement on developing problem-solving skills

Academic achievement had insignificant relationship with problem-solving skills (p-value = 0.422, t-value = 0.782 and β = 0.035). Therefore, hypothesis H2 was not supported. This finding indicates that academic achievement is not considered an important variable in the development of problem-solving skills. This result can be explained by the fact that students' academic achievement does not increase or decrease their motivation to care and develop problem-solving skills. In addition, the method of teaching in secondary schools is the reason for the general decline in the level of academic achievement of students due to following the method of memorization, as well as because the exams used to evaluate students do not focus on higher levels and problem-solving skills but rather focus on lower levels of concentration.

The moderating effect of academic achievement on the effect of technological skills on developing problem-solving skills

The result indicates that the interaction of technological skills*academic achievement is significant. In other words, this result gives the idea that high academic achievement leads to an increase in the relationship between technological skills and problem-solving skills.

CONCLUSION

The study had successfully investigated the effect of technological skills and academic achievement on problem-solving skills. The study has thus provided extra empirical support regarding academic achievement as a moderator for the evolving problem-solving skills literature.

The results also contributed to theoretical terms. First, although there have been numerous studies investigating problem-solving skills, this study highlighted a significant theoretical research gap by integrating the moderating role of academic achievement as a crucial construct in the education field. Second, the theoretical framework of the study also offers limited additional support for the importance and relevance of technological skills. In addition, the study has contributed to the scant literature on the importance of technological skills in the Middle East. Besides the theoretical donations provided by the study, the results offer substantial practical implications to teachers and administrators about how to improve the problem-solving skills of students.

Although this study highlights concerns in secondary school technology skills, academic accomplishment, and problem-solving skills, the samples utilized may not be real representations of the total secondary school population in Jordan due to the small sample size. As a result, the outcome may be skewed against generalizability. It is consequently advised that comparable research be undertaken with a larger sample size in other Jordanian Directorates of Education. Future investigations in this study environment are unlikely to provide the same results. This is due to the studied samples' homogeneity. Despite those limitations, this study's results cannot be disputed.

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