فعالية برنامج تعليمي مقترح قائم على الواقع الافتراضي في تنمية المهارات الاجتماعية لدى تلاميذ الصف العاشر في مادة الفيزياء

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كيفية اقتباس البحث

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The Effectiveness of a Proposed Instructional Program, based on the Hypothetical/Virtual reality, in Promoting Social Skills of 10th grade in Physics Subject

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الملخص

يُعد برنامج PhET من أكثر التقنيات ابتكارًا في التعليم المعاصر، وله تأثير إيجابي على التطور الأكاديمي والاجتماعي للطلاب. في الدراسة شبه التجريبية الحالية، شارك 44 طالبًا من الصف العاشر، ووُزِّعوا بالتساوي على مجموعتين: مجموعة تجريبية ومجموعة ضابطة (عدد الطلاب = 22 لكل مجموعة). أكملت كلتا المجموعتين الاختبارات القبلية والبعدية باستخدام استبيان مهارات اجتماعية من إعداد الباحث. استُخلصت بعض الخصائص السيكومترية للاستبيان، مثل تحليل الفقرات، الصدق و الثبات. بلغت قيمة معامل الثبات ألفا كرونباخ 0.83،

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والتجزئة النصفية 0.71، ومعامل إعادة الاختبار 0.81، على التوالي. تم التحقق من التوزيع الاعتدالي للبيانات باستخدام اختبار كولموغوروف–سميرنوف، ولم يُكتشف أي انحراف عن الطبيعية (القيمة لاختبار كولموغوروف > 0.05). استُخدمت الإحصاء الوصفي (المتوسطات والانحرافات المعيارية)، اختبار التائي للعينتين مستقلتين، مربع كاي، وتحليل التباين المشترك (ANCOVA)لتحليل البيانات. أظهرت النتيجة فروقًا ذات دلالة إحصائية بين المجموعتين في المهارات الاجتماعية، حيث بلغت قيمة16.13 = F، وقيمة0.0002 = p، و η2p = 0.282، مما يشير إلى أن طلاب المجموعة التجريبية استفادوا بشكل ملحوظ من مشاركتهم في البرنامج. وتشير هذه النتيجة إلى أن استخدام برنامج PhET كان له تأثير إيجابي و يلعب دورا مهما على تحسين المهارات الاجتماعية للطلاب.

Abstract

The PhET simulation programme is considered one of the most innovative technologies in contemporary education that has a positive influence on students' academic and social development. In the current quasi-experimental study, 44 tenth-grade students participated and were equally assigned to two groups: an experimental group and a control group (n = 22 per group). Both groups completed pre- and post-tests using a researcher-developed social skills questionnaire. Some psychometric properties such as item analysis, validity and reliability were extracted for the questionnaire. A sufficient Cronbach's alpha of 0.83 and split-half reliability of 0.71 and test re-test of 0.81 were reported, respectively. Normality of the data was checked using the Kolmogorov-Smirnov test and no deviations from normality were detected (p-value for the Kolmogorov test > 0.05). Descriptive statistics (means, standard deviations), independent sample t-test, chi-square and analysis of Covariance (ANCOVA) were utilized for the data analyses. The result showed statistically significant differences between groups in social skills, F= 16.13, p=.0002, η^2p= .282, indicating that the students in the experimental group gained significant benefits from their participation in the intervention. This finding suggests that the use of PhET simulations had a meaningful and positive impact on enhancing students' social skills.

Introduction:

Education is considered one of the vital principles in the development of societies and an asset for a country [1]. In the meantime, physics education, as one of the branches of natural science, serves as a bridge for interaction and identifying common features of various

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phenomena that occur in nature. Physics education can strengthen scientific attitudes such as accurate, fast, creative, and systematic thinking [2]. With the increasing technological advances and future competition, changes in the world of education must be made continuously to create better achievements in the future through the learning process.

Furthermore, students should not only master basic knowledge but also adapt to the social environment and creatively solve problems to compete globally (Yani & Widiyatmoko, 2023: 147). Social skill is essential for students' future success, enabling them to engage and collaborate effectively in learning environments. It includes a variety of skills that enable students to interact effectively with others and manage their learning responsibilities (Notari, Baumgartner & Herzog 2014:133). Students with strong social skills tend to exhibit good cooperation and interaction in both individual and group learning settings, thereby maximizing their involvement in the learning process (Hurst, Wallace & Nixon, 2013:376). In addition, social skills act as protective factors are associated with increased academic growth (Elliott et al., 2025: 32).

Hypothetical/virtual reality-based teaching methods are one of the new teaching methods that are used to benefit students' participation and understanding of complex and three-dimensional concepts. Virtual reality allows learners to interact and gain complete knowledge of the subject. It also increases students' participation, personalized learning, and cognitive understanding. Virtual reality can transform education and meet students' needs for participation, interaction, and inclusion with improved learning outcomes (Xi, 2024: 650). Virtual reality involves mental and imaginary situations that are recreated in the learning environment. It is related to simulation and scenario-building in the educational environment. Based on the learning environment, it is sometimes defined as a hypothetical/virtual reality. This concept represents a simulated reality and a hypothetical virtual reality that is as immersive as real reality and enables an enhanced life-like experience (Kuleva, 2023: 71). Among them, Physics Education Technology (PhET) simulation, introduced in 2002 by Nobel Prize winner Carl Wieman, is an example of interactive simulation technology that can improve science education (Tusoy & Baraquia, 2025: 22). PhET simulations not only present concepts but also guide students to discover the concept in reality (Susilawati et al., 2022: 1160). Considering the necessity of using an instructional program based on the hypothetical/virtual reality in the physics learning process, PhET simulation is used in this research.

Research evidence shows that social skills can be enhanced through educational intervention programs in schools. However,

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traditional educational methods, which are often prevalent in schools, focus solely on the active role of the teacher and neglect the role of students as an active element in the learning process. This is while modern educational trends focus on students as the main determinant of the learning and teaching process (Ramadan and Badi Younes, 2020: 1). Given the challenges of traditional education and developments over time, education programs have changed to better adapt to global demands and labor market needs. In this era, educational professionals must seek more advanced and learning-oriented approaches that encourage students' social skills (Syafrilianto & Rangkuti, 2020: 82).

Currently, however, there is no empirical research on the efficacy of educational interventions such as PhET simulation in promoting social skills among 10th -grade students. The current study aimed to examine whether participation in the PhET simulation, implemented as a highly structured educational intervention, can improve the level of students' social skills. Based on previous research it was hypothesized that students participating in as PhET simulation would significantly promote social skill compared to those who did not attend the intervention.

Hypotheses of the Research:

To answer the research question, these null hypotheses were formulated:

1.There is no statistically significant difference at the (0.05) significance level in the mean scores of the pre-test of social skills between the experimental and the control groups.

2.There is no statistically significant difference at the significance level of (0.05) in the mean scores of post-tests of the social skills between the experimental and the control groups.

Methods:

Experimental Design:

The current study utilized a quantitative approach with the type of quasi-experimental design, specifically equivalent control group with pre-test and post-test Design. Two groups were involved an experimental group and a control group, the experimental group implementation of treatment through PhET simulations integrated into their physics lessons, while the control group is a comparison class that taught traditional methods only. Both groups in this study were given a pretest and also a posttest to be able to see the differences in social skills of the two classes, Students assigned to the control group did not receive any intervention from the research project, but completed the questionnaires at the same time as the experimental groups.

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Table (1) shows clarity and completeness

Group	Pre-Test Administered	independent variable	Dependent variable	Post-Test Administered
Experimental	Creative thinking tests + Social Skills inventory	PhET simulation	Creative thinking tests + Social Skills	Creative thinking tests + Social Skills inventory
control		Traditional teaching followed		

Participants:

The researcher utilized a purposive sampling technique after identifying the research population, due to significant school boycotts affecting most schools in Sulaymaniyah City. The study sample was intentionally selected from Bekhal High School for Girls, consisting of 88 tenth-grade girls distributed across classes A, B, C, and D. From this population, two classes—C and D—were randomly selected, comprising 44 students. Using random sampling technique, these students were divided into two equal groups: the experimental group (n = 22) and the control group (n = 22).

Measures:

To measure the social skills of the research sample, a dedicated scale was developed as a key instrument for the study. Following an extensive search of the internet and a thorough review of relevant literature, so the researcher relied on the studies that had prepared these types of scales, drawing upon previous studies such as Abdul Hamid (2012), Karroum (2019), Dyab (2023). Based on these references, a preliminary scale consisting of 37 items was constructed to assess various dimensions of social skills. The items were formatted using a five-point Likert scale with response options (Always, Often, Sometimes, Rarely, and Never). Subsequently, several psychometric properties of the questionnaire such as item analysis, validity, and reliability were examined to ensure its appropriateness for the study.

Forward-Backward translation:

Considering that the original research sample was tested within the framework of the research experiment, the students were tenth-grade science students from Bexali Girls' High School, whose language of

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instruction is Kurdish. It was necessary to translate the experiment from Arabic into Kurdish by several translators who have expertise in both Arabic and Kurdish, this was accomplished through the following procedures. the social skill questionnaire was firstly translated from Arabic to Kurdish by an expert who was fluent in both Arabic and Kurdish, and then another expert translated the questionnaire back to Arabic. Lastly, the third one evaluated the content equivalence of each item and decided that the translation process was accurately done. In light of their observations and comments, some necessary adjustments were made to the wording of some items, and then it was reviewed by a Kurdish language expert to ensure linguistic accuracy.

Validity and Reliability of the Instruments

Content Validity:

Content validity refers to the extent to which a test's items are representative and relevant to the construct or behavior being measured. It ensures that the content adequately reflects all aspects of the intended domain, including the wording, format, and scope of items (Roebianto et al., 2023),

Content validity was confirmed by presenting the items of social skills questionnaire to a panel of experts which includes eighteen (18) experts specializing in education, psychology, measurement and evaluation and teaching methods. The Content Validity Index approach (%80) was employed; to obtain expert consensus on each item for approval and suitability that's it demonstrates strong agreement among experts, after considering the opinions, observations, and suggestions of experts and specialists regarding the removal and modification of some items. All the 37 items were retained.

Item Analysis of the Social Skills Scale:

Item analysis is a process employed to assess the quality of individual test items (questions) and their impact on the overall validity and reliability of a scale. It involves examining how examinees respond to each item, evaluating item difficulty, and determining how well items discriminate between high and low-scoring individuals. This analysis helps identify poorly performing items that may require adjustment or elimination, hence enhancing the assessment's quality and validity(Bozdoğan & Uzoğlu, 2012).

To conduct item analysis for the Social Skills Questionnaire, the researcher recruited (185) tenth-grade science students from Bekhal and Raz Girls' High Schools. Participants' scores were ranked from highest to

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lowest, and two comparison groups (high-scoring and low-scoring students) were formed based on the upper and lower (27%) criterion. This procedure resulted in (50) students selected for each group. Item discrimination was examined by comparing responses between the two groups, while item-total correlations were computed to assess the relationship between each item and the overall questionnaire score.

A)Item Discrimination:

To identify item-level differences between the two groups, the researcher applied the two-sample t-test. As shown in Table (2), the results indicated that there were no statistically significant differences at the (0.05) level for items (23 and 27). However, significant differences were found between the high and low scoring groups across all other items on the social skills inventory.

Table (2) shows the results of the independent samples t-test to assess the item discrimination on the Social Skills questionnaire.

item	Group	Mean	SD	t	sig	item	Group	Mean	SD	t	sig
1	High	4.72	.57	11.4	0.00	20	High	4.60	.73	3.86	0.00
	Low	2.20	1.44				Low	3.86	1.14		
2	High	4.42	.76	10.0	0.00	21	High	4.70	.58	4.57	0.00
	Low	2.76	.89				Low	3.90	1.09		
3	High	4.92	.27	6.21	0.00	22	High	5.00	.00	4.15	0.00
	Low	3.62	1.46				Low	4.74	.44		
4	High	2.94	.96	6.98	0.00	23	**High**	**4.22**	**1.04**	**0.67**	**0.51**
	Low	1.76	.72				**Low**	**4.06**	**1.35**		
5	High	4.58	.64	5.52	0.00	24	High	4.26	.75	7.43	0.00
	Low	3.44	1.31				Low	2.90	1.05		
6	High	4.94	.24	6.24	0.00	25	High	3.58	1.21	7.23	0.00
	Low	3.54	1.57				Low	1.88	1.14		
7	High	4.22	.58	4.31	0.00	26	High	4.24	1.04	4.82	0.00
	Low	3.40	1.21				Low	2.90	1.67		
8	High	4.82	.39	6.11	0.00	27	**High**	**3.54**	**1.23**	**0.13**	**0.89**
	Low	3.28	1.74				**Low**	**3.50**	**1.71**		
9	High	3.52	1.47	4.97	0.00	28	High	4.54	.76	6.75	0.00
	Low	2.16	1.25				Low	2.74	1.72		
10	High	3.96	.78	9.03	0.00	29	High	3.56	1.49	8.55	0.00
	Low	2.18	1.16				Low	1.54	.76		
11	High	4.86	.35	3.90	0.00	30	High	3.84	1.66	3.36	0.00
	Low	4.40	.76				Low	2.82	1.37		
12	High	4.40	.76	5.49	0.00	31	High	4.78	.58	4.26	0.00
	Low	3.30	1.20				Low	3.94	1.27		
13	High	4.26	.78	4.61	0.00	32	High	4.80	.40	6.95	0.00
	Low	3.20	1.43				Low	3.48	1.28		
14	High	3.60	1.16	2.87	0.01	33	High	4.42	.76	4.87	0.00
	Low	2.82	1.53				Low	3.38	1.31		
15	High	4.84	.37	2.75	0.01	34	High	3.98	.94	6.51	0.00
	Low	4.40	1.07				Low	2.44	1.39		
16	High	4.70	.84	4.81	0.00	35	High	4.12	.87	9.48	0.00
	Low	3.34	1.81				Low	2.24	1.10		
17	High	4.86	.35	2.91	0.00	36	High	3.96	1.03	6.11	0.00
	Low	4.42	1.01				Low	2.40	1.48		
18	High	4.78	.42	4.22	0.00	37	High	4.42	.70	7.08	0.00
	Low	4.06	1.13				Low	2.94	1.30		
19	0.00	4.48	.50	4.40	0.00						
	Low	3.44	1.59								

B)Item-Total Correlation:

Allen and Yen (2002) explained that at its foundation, item total correlation is a measure of how well each item contributes to the overall

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construct being measured, a greater correlation suggests that the item is consistent with the latent trait or concept the survey attempts to capture. The analysis of item-total correlations is a crucial step in developing and refining measurement tools. It helps researchers ensure that their criteria are internal consistency, valid, and accurately catch the intended construct.

Pearson's correlation coefficient was employed to assess the relationship between each item and the overall score on the social skills questionnaire. As shown in Table (3), the findings showed that all items, except items (23 and 27) had a statistically significant positive correlation between each Item and the total score of the questionnaire. Therefore, based on the analyses mentioned above, the item 23 and 27 were removed from the questionnaire.

Table (3) shows the results of item-total correlations for the Social Skills questionnaire.

item	correlation	sig	item	correlation	sig	item	correlation	Sig
1	80	0.00	14	.27	0.006	**27**	**.09**	**0.389**
2	.65	0.00	15	.30	0.003	28	.53	0.00
3	.59	0.00	16	.52	0.00	29	.60	0.00
4	.54	0.00	17	.28	0.004	30	.41	0.00
5	.60	0.00	18	.46	0.00	31	.42	0.00
6	.55	0.00	19	.33	0.001	32	.72	0.00
7	.55	0.00	20	.51	0.00	33	.49	0.00
8	.64	0.00	21	.44	0.00	34	.56	0.00
9	.61	0.00	22	.37	0.00	35	.62	0.00
10	.69	0.00	**23**	**.16**	**0.105**	36	.52	0.00
11	.48	0.00	24	.60	0.00	37	.64	0.00
12	.58	0.00	25	.46	0.00			
13	.53	0.00	26	.59	0.00			

The Exploratory Sample for the Social skills Inventory:

In order to ensure clarity of the instructions and items of the exam for students, determine the necessary time to conduct the exam in general, find the reliability level, identify the implementation situations, and any issues, obstacles or barriers if exist, the researcher conducted the exam on (16/1/2025) on a preliminary sample, which consisted of (40) students from the science 10th grade of(Raz Girls' High School), who are outside the main research sample and are at the same academic level. This sample was purposefully selected because due to the boycott of most schools in the city of Sulaymaniyah, most schools did not continue their studies, but the researcher contacted this school due to it continue to study. They were

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gathered in one of the school's classes, and the exam was conducted in a calm and peaceful environment. It is worth noting that the students did not present any significant problems during the exam, then the average time of the test was calculated by taking the answer time of the first student and the last student, which was an average of (30) minutes, Afterwards, their answers were corrected according to the criteria previously determined for this purpose, in order to put the answers under statistical analysis.

Reliability:

reliability refers to the consistency and stability of a measurement or test(Andersson et al., 2024). It indicates whether the same results can be obtained if the measurement or test is repeated under the same conditions and population. A reliable test will produce similar results each time it is used, regardless of who is using it or when it is used(Candrawati et al., 2025).

To find the reliability level of social skills scale the following types of reliability were used for that purpose by this way.

A)Internal consistency:

These methods are used to examine the homogeneity of items within the test (Field, 2017), two widely accepted techniques are used Cronbach's alpha and Split- Half equations to determine the internal consistency of the social skill inventory among (40) tenth grades students from (Raz Girls' High School). It was found that the measure has an acceptable value of reliability as showed that the Cronbach alpha and split half reliability values were (0.83) and (0.71) respectively.

B)Test retest:

To establish reliability, the researcher employed the test-retest method by re-administering the test to the same sample which consisted of (40) students after a two-week that is, on the date (30/1/2025) on Thursday. Pearson correlation was utilized and the results indicated a high reliability coefficient of 0.81, which is an acceptable value of the reliability based on the Viswanathan et al., (2017) recommendation.
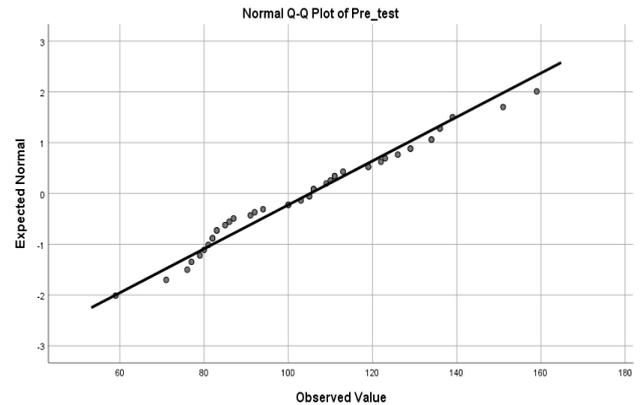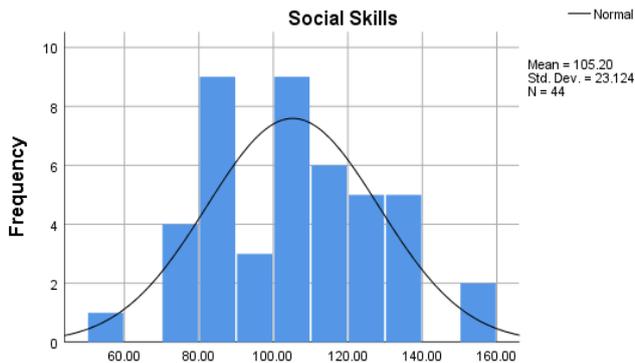
Normal distribution:

Normality of the pre-test data was assessed using the Shapiro–Wilk test, which is suitable for samples smaller than 50 participants. The findings indicated that, the data collected from the Social Skills Questionnaire met the assumption of normality. Consequently, parametric tests were employed for subsequent data analyses.

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Table (4) Shows normality of the used variable in the study

Social Skills	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
	.103	44	.200*	.975	44	.448

Graph (1) shows normal distribution of the used variable in the study

Intervention:

The PhET program was taught by the researcher over a period of eight weeks, with a total of six lessons per week—three lessons for each group. Each lesson lasted approximately 45 minutes. About one week prior to the intervention, pre-test data were collected from both the treatment and control groups using social skills questionnaire. Following the completion of the treatment, post-test data were obtained from both groups to assess the outcomes.

Equivalence of Research Groups:

It is critical to ensure equivalency between the experimental and control groups, when splitting the study sample, this means that in order for the comparison to be valid and reliable, the participants in both groups, should be similar in characteristics relevant to the subject of the study (Stefanos, Graziella & Giovanni 2020) .

To establish equivalence between the experimental and control groups, the accounted for many variables that could influence the independent variable. These includes:

1-The students' age (measured in months).

2-Level of intelligence.

3-The academic background of their parents.

4-Student's parents' occupation.

5-Physics achievement in the first semester.

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The Age (measured in month):

This variable was controlled due to its correlation with cognitive growth or mental maturity, which may influence the research outcomes. The researcher recorded the students' ages of each participant in months as of (February 10, 2025), which is the commencement of the experiment to ascertain the overall difference between the two groups An independent-samples t-test was conducted to compare the ages (in months) of students in the experimental and control groups. The mean and standard deviation of ages of both groups are shown in table (5). The findings illustrated that the experimental and control groups did not differ significantly, $t(42) = -0.81$, $p = .42$, $(P > 0.05)$, 95% CI [–6.50, 2.77], suggesting that the groups were comparable in age at the start of the program.

Table (5) Shows ages in month differences between study groups

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Age	Experimental	22	195.6	9.01	1.92
	Control	22	197.5	5.90	1.25

Intelligence:

The researcher employed an intelligence test that had been translated from English to Kurdish by (Baban,2012),the test was validated and shown to be reliable, having been previously administered and tested within the Kurdish population of the Iraqi Kurdistan Region, The test comprised 50 diverse items, with an established answer key for scoring, It was administered at the same time to both the experimental and control groups on January 28, 2025, before the beginning of the instructional program. Subsequently, the responses were scored by awarding (1) point for each correct answer and (0) points for each incorrect one. To compare IQ scores between the experimental and control groups independent-samples t-test was conducted. The mean and standard deviation of both groups are shown in table (6). The result showed that there was not significantly difference in IQ scores between groups, $t(42) = 0.43$, $p = .67$, $(P > 0.05)$,95% CI [−2.16, 3.34]. This result suggests the two groups were statistically equivalent in IQ at baseline. This supports the internal validity of the present study by illustrating that IQ does not act as a confounding variable affecting the study's results.

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Table (6) Shows IQ test differences between study groups

Group Statistics				
Group		N	Mean	Std. Deviation
IQ-test	Experimental	22	25.36	4.31
	Control	22	24.77	4.72

Students' Physics Achievement in first semester:

The experimental and control groups were equivalent in their physics grades for the first semester of the 2024–2025 academic year, as verified by the grade records provided by the school administration and presented in Table (7).to examine student's physics achievement in first semester independent-samples t-test was conducted. It was found that the difference between groups was not statistically significant, $t = 0.56$, $p = .58$, (P > 0.05), 95% CI [−6.99, 12.36], indicating that the groups were equivalent in physics achievement prior to the intervention.

Table (7) Shows descriptive statistics in physics achievement between the groups

Group Statistics					
	Group	N	df	Mean	Std. Deviation
Physics Achievement	Experimental group	22		52.45	18.68
	Control group	22	42	49.77	12.32

Parents' Educational background:

The researcher determined the educational qualifications of parents in both the experimental and control. Parental education was classified into four tiers: Level 1 (illiterate), Level 2 (basic), Level 3 (secondary), and Level 4 (diploma and higher). A chi-square test of independence was performed to investigate the relationship between group (experimental versus control) and maternal education level. The findings revealed no significant correlation, $\chi^2(3, N = 44) = 0.48$, $p = .92$ (p > 0.05), indicating that the two groups were equivalent regarding mothers' educational attainment. The analysis of fathers' education levels showed no statistically significant difference between the groups, $\chi^2(3, N = 44) = 0.45$, $p = .93$ (p > 0.05), showing similar distributions in both groups.

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Table (8) Shows students' parental educational background for both groups

Educational background		Experimental group	Control group	total	χ^2	sig
Mother Education	illiterate	3	3	6		
	Basic	8	6	14		
	Secondary	6	7	13	**0.48**	**.92**
	Diploma and above	5	6	11		
	Total	22	22	44		
Father Education	illiterate	3	3	6		
	Basic	8	6	14		
	Secondary	6	7	13	**0.45**	**.93**
	Diploma and above	5	6	11		
	Total	**22**	**22**	**44**		

Students' Economic Status:

The researcher determined the students' economic status based on these categories (low, meddle, good) and, after distributing the information form, was able to regulate this variable.As shown in the table (9), utilizing chi-square test revealed that there was no statistically significant between groups in this variable, $\chi^2(2, N = 44) = 2.47$, p = .29, (P > 0.05), suggesting that the experimental and control groups do not differ significantly in the distribution of economic status.

Table (9) Shows students' Economic Status between groups

Economic Status		Experimental group	Control group	total	χ^2	sig
Economic Status	Low	1	1	2		
	Middle	10	15	25	2.47	.29
	good	11	6	17		
	Total	**22**	**22**	**44**		

Parental Employment Status:

A chi-square test was utilized to inspect the association between groups and parents' employment status. The result demonstrated not statistically significant, $\chi^2(1, N = 44) = 0.36$, p = .55,(P > 0.05) between groups and mothers' employment status, suggesting that the distribution of employment status among mothers did not differ significantly between the experimental and control groups. Regarding the relationship between

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father's employment status and assignment group, the result of chi-square test showed not statistically significant, $\chi^2(3, N = 44) = 1.00$, p = .80, (P > 0.05), indicating no significant difference between the experimental and control groups.

Table (10) Shows students' parental educational background for both groups

Employment		Experimental group	Control group	total	χ^2	sig
Mother employment	House wife	14	12	26		
	Public Sector Employee	8	10	18	**0.36**	**.55**
	Total	22	22	44		
Father employment	Self-employed	14	14	28		
	Public Sector Employee	7	7	14		
	Retired	0	1	1	1.0	**.80**
	Unemployed	1	0	1		
	Total	**22**	**22**	**44**		

Implementation period:

To ensure consistency during the experimental period, the researcher conducted the study within the same school for both the experimental and control groups during the second semester. The instructional intervention began on February 10, 2025, with both groups receiving three 45-minute lessons per week. The experimental group was taught using the PhET-based program, whereas the control group received instruction through the traditional teaching method. The implementation ended on April 10, 2025.

The scientific content covered in the study was selected from Sections Four and Five of the *Science for All: Physics – Student Book for 10th grade, Eighth Edition (2016 AD)*. This selection was based on the duration of the experimental period, the researcher's expertise, and advice of a high school physics teacher, along with from several experts in the fields of physics and instructional methodology. The specific subjects are described in depth.

Results and Discussion:

Analysis one: prior the training session:

H1: There is no statistically significant difference at the (0.05) significance level in the mean scores of the pre-test of social skills between the experimental and the control groups. Prior to the

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intervention, an independent samples t-test was performed in order to test for differences between the experimental and control groups on the pretest scores of social skills. The result showed no statistically significant differences in the pre-test scores between treatment and control groups, t(42) = 0.31, p = .75, (P > 0.05), 95% CI [–11.99, 16.44], Therefore, the null hypothesis was accepted, suggesting that both groups were equivalent in social skills at the start of the intervention.

Table (11) Shows descriptive statistics in social skills between the groups

Group Statistics					
	Group	N	df	Mean	Std. Deviation
Social skills	Experimental group	22	42	96.3	25.5
	Control group	22		94.1	20.1

Analysis two: Post training session:

H2: There is no statistically significant difference at the significance level of (0.05) in the mean scores of post-tests of the social skills between the experimental and the control groups.

In order to test the hypothesis that students participating in PhET program would significantly improve their social skills compared to those who did not attend PhET, an analysis of covariance ANCOVA (with pre-test scores as the covariate) was performed. As shown in Table (12), the result of the ANCOVA showed statistically significant differences between groups in social skills inventory, F= 16.13, p=.0002, η2p= .282, suggesting that the students in the experimental group gained significant benefits from their participation in the intervention.
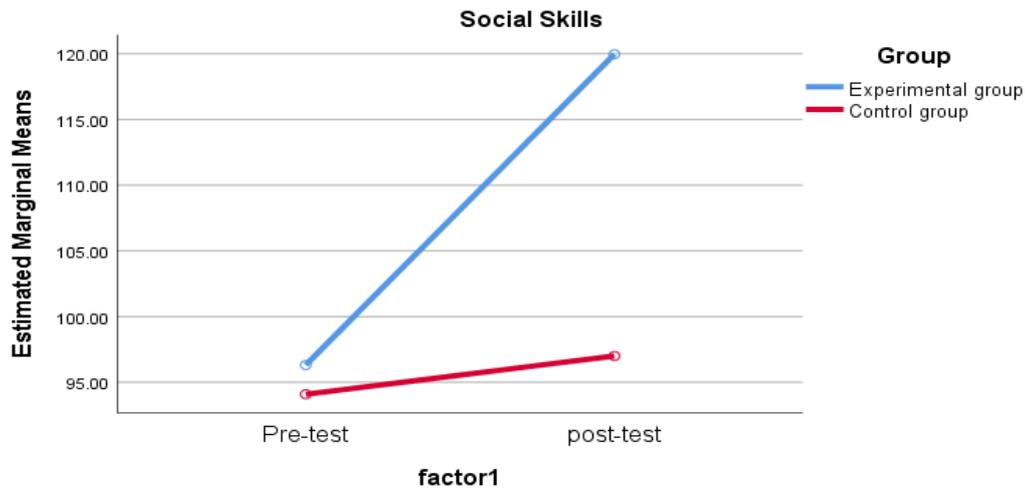
Table (12) Shows the result of ANCOVA in Social skills between groups

		Experimental group		*Control group*					
	Tests	*Mean*	*SD*	*Mean*	*SD*	*df*	*F*	*P*	$\eta^2 p$
Social Skills	Pre-test	96.3	25.5	94.1	20.1				
	Post-test	119.95	22.75	97.0	14.31	1	16.13	.0002	.282

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Graph (2) illustrates the changes in social skills between groups

Discussion:

The main aim of this study was to examine whether PhET is an effective intervention to improve social skills among 10th grades Kurdish students in the physics subject. In common with previous findings (Jannah et al., 2021; Rahayu and Wibowo, 2023) our results showed that there was a statistically significant difference between the treatment and control groups on social skill. One possible reason for this result is that teaching using the PhET program was a motivator for students to participate actively and enthusiastically in the classroom during all experimental lessons, by striving to answer the hypothetical questions raised by the researcher within the framework of the research examination lesson topics. At the same time, the home assignments. Undoubtedly, such a situation is not easily available in traditional method lessons, which shifted the scales in favor of the experimental group students in this regard.

It can be said that using this program played an important role in clarifying abstract concepts and visualizing things that couldn't be seen through these concepts, as well as changing factors and observing their outcomes, for any scientific subject and idea in each lesson. This also made students' learning based on thinking rather than accepting any information given to them.

The findings from the present study provide additional evidence for the positive impact on social skills after participation in the PhET training programme. PhET simulation improved social skill among students which ultimately may be a key mechanism for prompting in their academic growth (Elliott et al., 2025: 32). These findings are promising because it has previously been concluded in the literature that there is a

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strong relationship between social skills with involvement in the learning process (Hurst et al., 2013:376).

This aligns with Vygotsky's social constructivist theory (1978), which emphasizes that learning occurs through social interaction and collaboration. PhET simulations encourage peer discussion, collaborative problem-solving, and joint experimentation, all of which cultivate social skills, enhance teamwork, and improve student communication. Thus, integrating PhET simulations into physics instruction appears effective in enhancing students' social skills by increasing participation and interaction.

In conclusion, this study was conducted among a group of 10th grade students and based on the findings, the current study eventually showed that the intervention can be helpful for student to improve the social skills which in turn may lead to increasingly positive outcomes in both their academic and social lives

Implications for practice:

The results of this study are consistent with most studies in the literature that emphasize the effectiveness of PhET simulations in enhancing students' social skills. The findings suggest that PhET simulations can be successfully integrated into secondary school curricula to support social development. Our results indicate that PhET simulation can be implemented in secondary school. Educators could have an important role in facilitating and guiding students' use of such technologies to development social skills.

References:

1.Susilawati, A., Yusrizal, Y., Halim, A., Syukri, M., Khaldun, I., & Susanna, S. (2022). The effect of using physics education technology (PhET) simulation media to enhance students€™' motivation and problem-solving skills in learning physics. Jurnal Penelitian Pendidikan IPA, 8(3), 1158-1167.

2.Syafrilianto, S., & Rangkuti, A. N. (2020). A Profile of Social Skills of Students in Learning Physics through a Problem-Posing Approach. Berkala Ilmiah Pendidikan Fisika, 8(2), 82-90. https://ppjp.ulm.ac.id/journal/index.php/bipf

3.

4.Abdel Hamid, Nada Nasr El-Din (2012). Social Skills Scale for Adolescent Girls, Ain Shams University. Psychological Counseling Center, 291 – 309. http://search.mandumah.com/Record/161990

5.Allen, M. J., & Yen, W. M. (2001). Introduction to measurement theory. Waveland Press.

6.Andersson, M., Boateng, K., & Abos, P. (2024). Validity and Reliability: The extent to which your research findings are accurate and consistent. Civil Engineer and Researcher. https://www.researchgate.net/publication/384402476Bacil et al., 2015)

7.Bozdoğan, A. & Uzoğlu, M. (2012). The development of a scale of attitudes toward tablet pc. Mevlana International Journal of …, 2(2), 85–95. http://79.123.150.20/xmlui/handle/123456789/249

8.Candrawati, E., Uliyandari, M. & Prahani, B. K. (2025). Analyzing Student Reactions to Interactive Learning Materials and Critical Thinking Capabilities Using

Journal of Babylon Center for Humanities Studies :2026 Volume: 16 Issue :2
(ISSN): 2227-2895 (Print)   (E-ISSN):2313-0059 (Online)

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the Rasch Model. Science Education Journal (SEJ), 9(1), 37–59. https://doi.org/10.21070/sej.v

9.Dyab, S. (2023). Scale of Social Skills for University Students. Journal of Qena Faculty of Arts, 32(59), 1223-1254. doi: 10.21608/qarts.2023.197201.1639

10.Jannah, W., Evendi, E., Safrida, S., Ilyas, S., & Syukri, M. (2021). Improvement of Learning Outcomes, Motivation, and Achievement of Students' Social Skills by Applying Student Teams Achievement Division Cooperative Learning Model through PhET Simulation Media. Jurnal Penelitian Pendidikan IPA, 7(4), 775-781. doi:https://doi.org/10.29303/jppipa.v7i4.796

11.Elliott, S. N., Anthony, C. J., & Murthy, H. (2025). Teaching social skills that enable learning and healthy relationships in high-achieving students. Gifted Education International, 41(1), 32-56.

12.Field, A. (2017). Discovering Statistic Using IBM SPSS Statistic 5th. Sage Publication, 53(9), 1689–1699.

13.Hurst, Beth, Randall Wallace, and Sarah Nixon. (2013). The impact of social interaction on student learning. Reading Horizons (Online) 52, no. (4) : 375-398

14.Karroum, M. (n.d.). The factorial structure of the social skills test and its relationship to some personality variables (Doctoral dissertation, Université Mohamed Ben Ahmed d'Oran 2).

15.Kuleva, M. (2023). Application of virtual reality to the enhancement of physical activity and sports for healthy individuals. A systematic review. *Journal of Applied Sports Sciences*, *7*, 69-79.

16.Notari, M., Baumgartner, A., & Herzog, W. (2014). Social skills as predictors of communication, performance and quality of collaboration in project-based learning. Journal of Computer Assisted Learning, 30(2), 132-147.

17.Rahayu, T., & Wibowo, W. S. (2023). The development of PhET-assisted inquiry-based electronic worksheets to improve communication and collaboration skills. *JPPIPA (Jurnal Penelitian Pendidikan IPA)*, *8*(1), 27-34.

18.Ramadan, Mahmoud and Badie Younes, Shorouk Samer (2020). The Effect of Using the Format Model on Creative Thinking and Education in General, at Maqam Al-Safa Al-Thamim in the Governorate of Nablus. Master's Thesis, An-Najah National University.

19.Roebianto, A., Savitri, S. I., Aulia, I., Suciyana, A. & Mubarokah, L. (2023). Content Validity: Definition and Procedure of Content Validation in Psychological Research. TPM - Testing, Psychometrics, Methodology in Applied Psychology, 30(1), 5–18. https://doi.org/10.4473/TPM30.1.1

20.Stefanos, R., Graziella, D. A., & Giovanni, T. (2020). Methodological aspects of superiority, equivalence, and non-inferiority trials. Internal and Emergency Medicine, 15(6), 1085-1091.

21.Tusoy, M., & Baraquia, L. (2025). The Use of PhET Simulations in Evaluating Students' Level of Cognitive Skills Utilizing Solo Taxonomy. Journal of Education and Learning Reviews, 2(1), 21-38.

22.Viswanathan, M., Kayande, U., Bagozzi, R. P., Riethmuller, S., & Cheung, S. Y. (2017). Impact of questionnaire format on reliability, validity, and hypothesis testing. TPM: Testing, Psychometrics, Methodology in Applied Psychology, 24(4)

23.Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

24.Xi, W. (2024). Virtual reality integration in teaching practices for enhanced learning experiences. In 2024 IEEE 4th International Conference on Electronic Communications, Internet of Things and Big Data (ICEIB) (pp. 650-653). IEEE.

25.Yani, L. P., & Widiyatmoko, A. (2023). The Effectiveness of the PhET-Assisted Creative Problem-Solving Model on Students' Creative Thinking Abilities and Cognitive Learning Outcomes. Jurnal Inovasi Pendidikan IPA, 9(2), 146-156.

Journal of Babylon Center for Humanities Studies :2026 Volume: 16 Issue :2
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