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IMPACT OF 7E MODEL ON STUDENTS' ACADEMIC ACHIEVEMENT: A COMPREHENSIVE ANALYSIS IN EDUCATIONAL SETTINGS

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ABSTRACT

The 7E model of instruction, encompassing "Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend", has emerged as a prominent framework for promoting active learning and student-centered instruction in educational settings. This study aimed at comprehensively analyzing the impact of the 7E model on students' academic achievement across diverse educational contexts. In order to evaluate how well the 7E model improves students' academic performance, cognitive abilities, and affective outcomes, quantitative data will be analyzed. The research was conducted using a quasi-experimental design as the methodology. The study involved 10th grade students learning "physics" at public high and higher secondary schools in the Sargodha district. A strategy that involved many stages of sampling was used to choose a representative sample. Two secondary schools were selected with ease in the first round in Sargodha City, out of 11 girls' schools and 15 boys' schools. For the second phase, two classrooms of the 10th grade from each school were chosen at random. Two control groups and two experimental groups were created at random. The instrument was utilized as a pre-test and post-test i.e., Achievement Test in Physics (ATP). The reliability of the research instrument was evaluated using Cronbach's Alpha, and it was found to be reliable. For the analyzing data, independent samples t-test, and ANOVA were used. Additionally, the study will explore the applicability of the 7E instructional model across various subject areas and investigate factors influencing successful implementation, such as teacher training, classroom environment, and institutional support structures. By offering comprehensive insights into the impact of the 7E instructional model on students' academic performance, this research aims to inform educators, policymakers, and educational stakeholders in their efforts to promote effective teaching and learning practices that foster student success and engagement in educational settings.

Keywords: 7E instructional model; Physics; Academic achievement; Secondary level students.
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INTRODUCTION

The curriculum, the teacher, and the student are the three cornerstones of education. The educational process is successful when it is well-planned and executed. In the teaching and learning process, the teacher is quite important. Our educational goals dictate the subject we study and the methods of instruction we use. Over time, the goals of education have evolved, and teachers have always worked to improve the way they teach the curriculum. What we want students to learn and be able to do informs our teaching strategy. The developments have caused a change in how people view instruction. The formation and achievement of concepts can help learning objectives be accomplished. One of the main topics of discussion in the education community today is the ongoing quest for innovative teaching strategies that encourage in-depth learning and enhance student performance. One such model that has attracted attention is the 7E model,

which has the ability to completely transform teaching and learning methodologies. The 7E methodology guides instructors through the following seven phases of education: “Elicit, Engage, Explore, Explain, Elaborate, Evaluation, and Extend”. The 7E model of the constructivist approach is based on constructivist theory. This paradigm, which emphasizes on active learning, inquiry-based methods, and student-centered instruction, is strongly in line with the goals of contemporary education, which includes the development of problem-solving skills, critical thinking, and lifetime learning competencies (Bybee, 2014).

It is crucial to understand how the 7E model affects students' educational overall performance as academic stakeholders search for studies-based strategies to increase student fulfilment and foster significant learning opportunities. The 7E model may be useful, as anecdotal proof and theoretical frameworks suggest; nevertheless, there's a scarcity of empirical research that gives complete opinions of the model's achievement in a number of instructional settings. This look at will provide an in-intensity knowledge of how the 7E model influences student fulfilment, ability sets, and values through statistics integration. This look at making a speciality of the ongoing debate on the strengths of teaching and the purchase of intellectual abilities in state-of-the-art schooling, coaching and gaining knowledge of approximately the teaching technique, schooling, proof-based totally learning and the usage of educational substances through the 7E model for creating instructional substances. Effects. In the look for effective teaching techniques that promote significant studying and enhance student learning, educators continue searching for bendy getting-to-know models. Version 7E is one of the fashions that has attracted attention in studies and practice. The 7E model is an extension of the traditional 5E model; it expands and supports collaboration, discovery, rationalization, improvement, and assessment (Kahveci & Lee, 2014). This comprehensive framework emphasizes lively studying, inquiry-based approaches, and scholar-focused instruction, aligning intently with cutting-edge educational goals to sell essential thinking, trouble-solving skills, and deeper conceptual knowledge to secondary school students.

While the theoretical underpinnings of the 7E model recommend its capability to convert coaching and mastering practices, empirical evidence concerning its effect on students' instructional performance stays constrained and fragmented. Existing research has presented insights into precise factors of the 7E model's effectiveness, together with elevated scholar engagement, progressed conceptual knowledge, and greater trouble-fixing skills (Bursal & Paznokas, 2006; Erdem, 2014). However, a comprehensive analysis that systematically examines the connection between the implementation of the 7E model and students' overall academic success throughout various instructional settings is needed to tell proof-based instructional practices.

Thus, this study ambitions to deal with this gap with the aid of conducting a comprehensive analysis of the effect of the 7E model on students' overall performance in academic settings. By synthesizing current literature, gathering empirical records, and using each quantitative and qualitative study's methods, this observation seeks to offer insights into how the 7E model impacts students gaining knowledge of outcomes, cognitive processes, and affective elements. Through rigorous evaluation and interpretation of findings, this study endeavours to offer practical insights, actionable tips, and implications for educators, policymakers, and academic stakeholders looking to beautify teaching and getting-to-know practices through the employment of the 7E model.

In modern schooling, the search for powerful instructional methods that optimize scholars' knowledge of outcomes is ever-given. One such approach gaining attention is the 7E model, a pedagogical framework designed to engage students actively in the learning method whilst selling deep information and retention of content material. The 7E version incorporates seven sequential stages: *“Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend”* (Baden and Major, 2004). Each bankruptcy is cautiously designed to encourage students' reviews of comprehension and inspire inquiry, important inquiry, and critical wondering. Although the theoretical underpinnings of the 7E version advise that it has the potential to improve ordinary student mastering, the evidence base for its effectiveness remains scarce and dispersed.

Although some studies display nice effects concerning the use of the 7E version, other research has produced blended effects or centered on the consequences of the model (Kahveci and Lee, 2014; Guzey et al., 2016). Therefore, there may be a want to complete tests inspecting the connection between the 7E instructional model and student academic achievement success in diverse educational settings.

LITERATURE REVIEW

The 7E instructional model is an academic framework that courses instructors through seven consecutive phases of preparation and has won prominence in educational studies and exercise because it lets students engage students, stimulates learning, and promotes deeper knowledge. However, the theoretical underpinnings of the 7E model show its effectiveness in enhancing student getting-to-know effects, empirical studies examining its impact stay constrained and fragmented. This literature overview ambitions to identify present studies and discover the connection between using the 7E model and student performance in one of a kind instructional setting. The 7E model is primarily based on the constructivist getting to know concept, which argues that scholars actively create information through interplay with their surroundings. Each phase of the 7E model well known—getting rid of, attractive, exploring, clarifying, clarifying, comparing, and increasing—is designed to help scholars master and inspire inquiry, reflection, and alertness of information (Baden & Major, 2004). By offering students with possibility to take part in lots of ways, the 7E model is designed to promote deep mastering and boom educational fulfilment. While narrative and theoretical frameworks show the nice results of the 7E model, empirical evidence additionally helps its effectiveness in enhancing scholar mastering with advantageous effects. Many research has reported wonderful consequences associated with the usage of the 7E model, together with student engagement, advanced understanding, and progressed trouble-fixing (Iqbal et al., 2022; Kahveci & Lee, 2014; Erdem, 2014). For example, Kahveci and Lee (2014) found that pre-provider teachers who have been uncovered to the 7E mastering cycle model constantly had a better knowledge of differentiation and transition strategies than assistants. Despite the positive effects, there are problems in the use and assessment of the 7E model. Research has found that factors which include instructor schooling, coaching substances, and lecture room environment are essential determinants of model effectiveness (Guzey et al., 2016). Additionally, changes in training, content, and students can also affect the effects of 7E model implementation, highlighting the want for contextual concerns. The 7E model fashionable is at the heart of religious schooling and emphasizes participation, studies-based methods and scholar coaching. Each degree of the 7E model (touching on, exploring, explaining, elaborating, comparing, increasing, and reinforcing) is designed to guide scholars in getting to know and expanding deeper know-how (Bybee, 2014). Additionally, Iqbal et al. (2021) examined how the 7E instructional model improved vital questioning, creativity, and hassle-fixing in physics students. Research on the impact of the 7E model on students gaining knowledge has produced mixed results. Various research has proven effective effects related to the use of the 7E model, including advanced check rankings, improved collaboration, and deeper expertise (Iqbal et al., 2021; Iqbal et al., 2022; Kahveci and Lee, 2014; Guzey et al., 2016), others have located restricted or inconsistent results (Erdem, 2014). For example, Kahveci and Lee (2014) observed that scholars exposed to the 7E mastering model showed more expertise in medical information than students inside the conventional paper coaching organization. However, there are many factors which could affect the effectiveness of the 7E model in enhancing student gaining knowledge of results. These include trainer schooling and teaching capabilities, teaching materials and sources, lecture room climate and lifestyle, and scholar traits inclusive of previous information and revel (Guzey et al., 2016). Additionally, contextual factors such as school policies, curriculum requirements, and socio-economic conditions may impact the implementation and outcomes of the 7E model.

Academics are defined as those studies or education that are generally associated with schools, colleges universities or any other educational institutions. Achievement is when a student attains something by using his or her skills, abilities, and efforts to complete all stated objectives prescribed by an institution

successfully (Oxford, 2016). Academic achievement is truly the performance of the learner after completing an approved course of studies. In the Pakistani education system achievement is considered as marks are scores obtained in any terminal public examination e.g. secondary school certificate (SSC) examination which has an aspect of assessment of performance in terms of examination of practical activities. But in written examination items about higher order thinking are usually not/less included.

The success of science students is a big concern to science subject teachers. According to Razali et al. (2018) pointed out that the performance of students in science subjects is low in both formative and summative assessments. There are several reasons why secondary school students show poor academic performance in science subjects, especially in physics i.e. student attitude towards physics, lack of interest in physics, induction training of science teachers at the time of recruitment, focus on rote memorization, inappropriate teaching methods of science subjects, the non-responsive attitude of parents on monthly parents-teacher meetings, lack of science laboratories resources and equipment for practical.

However, Abed et al. (2019), exposed based survey of schools that insufficiency of laboratory equipment in school and inadequacy of good instructional materials used by teachers in school, negatively affect on learning process in the schools. However, Suleman et al. (2017) pointed out that, the lack of qualified teachers, teaching experience, and/or the lack of equipment or facilities available at laboratories are the fundamental reasons for student failure or poor performance globally. Some psycho-social variables i.e. learner attitude, interest, motivation, locus of control self-esteem and efficacy can predict the academic achievement of students in physics. Psycho-social constructs or attributes are those that hold both on sociological and psychological features. These constructs or factors may facilitate the relationship of a person with the social environment and the psychological growth (Farooq et al., 2011).

Statement of Problem

For secondary science students, physics is essential because it fosters the development of 21st-century abilities including imagination, problem-solving, or making choices. These skills are thought to be vital for students to develop into responsible citizens and lifelong learners. Because physics is a conceptual science, it is seen that students struggle to grasp its ideas because the material is abstract. Physics is perceived as a challenging and confusing science, making it a challenging undertaking to teach. In Pakistan, physics is often taught using a conventional approach that prevents students from participating in the process of critical thinking. As a result, the fundamental components of learning physics—meaningful and conceptual understanding—are disregarded in the teaching methodology. In the realm of education, teaching and learning models are gaining popularity and are being used to teach a variety of courses at all academic levels, from high school to university. Eisenkraft (2003) presented the constructivist approach more relevant and complete 7E model. In secondary science classes, it could foster the development of conceptual and meaningful knowledge as well as problem-based learning. Therefore, the goal of the study was to ascertain how the 7E model of the constructivist approach influenced the academic performance of secondary school students in the physics course.

Theoretical Framework

The 7E educational model, which employs a constructivist approach, is a seven-step work plan designed to enhance academic accomplishment and epistemological knowledge of science topics (Eisenkraft, 2003). This is one of the teaching models that is used in many courses to simplify topics. The aim of this example is to enable students' rapid and effortless acquisition of concepts. Thus, increasing academic success may benefit from the student-centered 7E educational paradigm.

Objective of the Study

The following objectives were designed for the study.

1. To find the effect of 7E instructional model on the academic achievement of students.

2. To find out the difference in academic performance among high, average, and low academic achievers.

Hypothesis

Following hypotheses were tested.

H_{01}: The mean gain scores of students in the experimental and control groups on the physics achievement test are not significantly different.

H_{02}: The mean gain scores of male and female students in both the control and experimental groups on the physics achievement test are not significantly different.

METHODOLOGY

Campbell and Stanley's (1966) quasi-experimental approach was used in this investigation. There were two ranks for each of the unbiased variables: gender and instructional approach. In order to reveal all possible combinations of the two impartial variables inside the chosen levels, a 2x2 factorial design was employed (Cheema & Mirza, 2013). The study's accessible population consisted of all tenth-grade students enrolled in "Government Girls' Higher Secondary School Hyderabad Town, Sargodha" and "Government Boys' Comprehensive High School Sargodha". The study's target population consisted of all tenth-grade male and female science students who were registered in public secondary schools in the Sargodha area and were reading physics. To choose a representative multistage sampling procedure was adopted. In boys school the two sections out of six sections of science students were randomly selected and randomly assigned as control and experimental groups each had 46 and 42 students, respectively. On the other hand, two sections of science students out of four in girls' school were randomly selected as control and experimental groups each had 41 and 40 students respectively.

Research Instrument

Research instrument; Achievement Test in Physics (ATP) was developed, to measure the impact of 7E instructional model (independent variable) on academic achievement (dependent variables). After literature review, many achievement tests in physics were found such as Physics Scientific Literacy Achievement Test (PSLAT) for secondary level (Adeleke & Joshua, 2015), Achievement test in Modern Physics (ATMP) for 10th grade students' (Balta & Eryilmaz, 2020), Modern Physics Achievement Test (MPAT) for secondary level students (Effiong et al., 2014), Achievement test in Physics (ATP) for 10th grade students (Wambugu & Changeiywo, 2008). But no achievement tests in physics were found according to the Pakistani context which accomplished the need for a secondary-level Physics curriculum. The standards of curriculum and mode of assessment among the different countries of the world are mismatched because of their educational aims, objectives and goals. Knowledge level is the most often utilized evaluation tool in Pakistani schools. Because of this, the Physics Achievement Test was designed using Bloom's Taxonomy's levels of cognitive domain, or "knowledge, comprehension, and application or above."

The test consisted of sixty (60) multiple-choice (MCQs) items. Forty (40) items have been selected for the final test after the pilot test.

Validation of the Achievement Test in Physics

The research Instrument was validated in two ways:

a) Five (5) peers discussed the Physics "ATP" achievement test. It was asked that peers with M.Sc. (Physics) or higher academic level and a B.Ed. or higher professional degree verify the content and vocabulary correctness. Peers examined the translation of achievement test in physics (ATP) and found that Urdu and English test phrases convey the same meaning. On the recommendations of peers, changes in the translation were made and a few items of the instrument were eliminated, some were merged together.

b) Seventeen (17) experts (8 local and 9 international) were given the opportunity to check the face and content validity of achievement test and also share their feedback on rubrics.

According to the views of the experts, instruments was modified and improved. Afterwards, a pilot study was directed for item analysis of the instrument and establishing reliability. This section covers the process of pilot testing, item analysis and coefficient of reliability.

Reliability of Achievement Test in Physics

Table 1. Reliability statistics of achievement test in Physics.

Instrument	Cronbach's Alpha	Decision
Achievement Test in Physics (ATP)	0.89	Very Good

Table 1 shows that the reliability coefficient of the achievement test in physics was found to be 0.89. The reliability coefficient of instrument was within acceptable range. Therefore, the instrument to be used in current study was considered as reliable and valid. Furthermore, item analysis in terms of item difficulty, and discrimination index was carried out and range of item difficulty of test was from 0.39 to 0.70 and the range of discrimination index of test was from 0.39 to 0.94. Hence the instrument was deemed reliable and valid.

ANALYSIS OF DATA FROM ACHIEVEMENT TEST IN PHYSICS

In order to test the hypothesis, the achievement scores of the students in the control and experimental groups were compared, and the mean gain on achievement scores was determined by deducting the pre-test scores from the post-test results;

Table 2. Overall difference of gain scores on achievement test.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	87	10.25	4.48	10.04	167	0.000	2.44
Control	82	4.70	2.27				

*p<0.05

Students in the experimental group ($M = 10.25\ and\ SD = 4.48$) that received coaching using the 7E Eisenkraft (2003) model outperformed students in the groups of control ($M = 4.70\ and\ SD = 2.27$) that received coaching using traditional techniques, as evidenced by the higher imply gain rating and larger impact length of Cohen's$d = 2.44 > 0.8$. As demonstrated by $t\ (167) = 10.04$, df = 167, and $p = 0.00$ less than 0.05, Table 2 shows that students in the control and experimental firms had significantly remarkable suggest gain ratings at the physics achievement test refuting the null hypothesis.

After analyzing overall difference of mean gain scores, now the gender-based analysis is presented as follows.

Table 3. Comparing male students' mean gain achievement scores.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	46	8.69	3.83	7.74	84	0.00	2.95
Control	40	3.60	1.72				

*p<0.05

Table 3 exposes that male students of experimental groups ($M = 8.69\ and\ SD = 3.83$) dealing with the 7E instructional model obtained more achievement rankings than male students of control groups ($M = 3.60\ and\ SD = 1.72$) taught through conventional methods, according to the more implied benefit score with the larger effect of $Cohen's\ d = 2.95 > 0.8$. Table 3 indicates that, as $t\ (84) = 7.74, df = 84$, and

the value of $p = 0.00$ less than 0.05, the gap suggests advantage scores inside the success check of physics test between male students shielded on top of things and experiment groups becomes substantial.

Table 4. Comparing female students' mean gain achievement scores.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	41	11.97	4.60	6.71	81	0.00	2.74
Control	42	5.76	2.26				

*p<0.05

In light of this, the more implied advantage score (M = 11.97 and SD = 4.60) with the larger effect length of $Cohen's\ d = 2.74 > 0.8$ verified that female students in the experimental group using the 7E instructional model received higher success ratings than female students in the group of control (M = 5.76 and SD = 2.26), who were taught using traditional methods. Table 4 shows that there is a significant difference in the mean gain ranks in the physics achievement test between female students in experimental groups and female students in control groups, with $t\ (81) = 6.71, df = 81, and\ p = 0.00\ less\ than$ 0.05.

Students' achievement levels wise analysis of the control and treatment groups

Table 5. Comparing high achievers' mean gain achievement scores.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	19	5.26	2.42	2.03	35	0.000	0.35
Control	18	3.88	1.56				

*p<0.05

Table 5 shows that, as indicated by $t\ (35) = 2.03, df = 35$, and $p = 0.00$ much less than 0.05, the gap in propose advantage scores in the physics fulfillment exam among high achiever students put on top of things and experimental enterprises got gigantic. Thus, the extra suggest gain score ($M = 5.26\ and\ SD = 2.42$) with the impact size $Cohen's\ d = 0.35$ less than 0.5 indicates that high achiever students in the experimental groups using the 7E instructional model achieved higher fulfillment rankings than high achievers in the control groups (M =3.88 and SD=1.56) instructed using conventional teaching techniques.

Table 6. Comparing average achievers' mean gain achievement scores.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	27	9.25	3.04	6.55	51	0.000	2.15
Control	26	4.42	2.24				

*p<0.05

Table 6 describes that, the average students of experimental group using the 7E instructional model had higher fulfillment ratings than average students ($M = 4.42\ and\ SD = 2.24$) who were taught using traditional coaching methods. This is indicated by the greater suggest benefit rating ($M = 9.25\ and\ SD = 3.04$) and the large effect size of $Cohen's\ d = 2.15 > 0.8$. Average achiever school students in the control and experimental groups demonstrated a significant difference in suggest gain ratings in the achievement test in physics, as demonstrated by $t\ (51) = 6.55, df = 51, and\ p = 0.00$ considerably less than 0.05.

Table 7. Comparing low achiever students' mean gain achievement scores.

Groups	N	Mean	SD	t	df	p-value	Effect Size
Experimental	41	13.21	3.60	11.32	77	0.000	3.2
Control	38	5.289	2.47				

*p<0.05

Table 7 shows that, for the low-reaching students allocated to the manage and experimental groups, there was a significant difference in the propose benefit scores on the physics achievement test, as shown by t (77) = 11.32, df = 77, and p = 0.00 much less than 0.05. This is demonstrated by the higher effect size $Cohen's\ d\ = 3.2 > 0.8$ and the additional suggest advantage rating ($M\ =\ 13.21\ and\ SD\ =\ 3.60$) of experimental groups. According to the results, low achiever students in control groups($M\ =\ 5.289\ and\ SD\ =\ 2.47$), who were taught standard coaching tactics, had lower fulfillment ratings than low achiever students in experimental groups that used the 7E instructional approach.

The achievement level analysis within experimental groups is shown below.

Table 8. ANOVA result for different achievement level.

Source	SS	Df	MS	F	Sig.	Effect Size Eta squared (η2)
Between Groups	468.207	2	234.103	54.621*	0.000	0.565
Within Group	360.023	84	4.286			
Total	828.230	86				0.434

*p<0.05

Table 8 presents the findings, which indicate that there was a significant change in the mean advantage ratings in the physics achievement test between students with different success levels. The desk beneath just displays the most striking effects. This was indicated by $F\ (2, 84)\ =\ 54.621, p\ =\ 0.000$ less than 0.05, and a small Effect Size Eta squared (η^2) = 0.434 and 0.565 around 0.525. Post hoc analysis (LSD) is done to investigate how the various agencies differ from one another. The post hoc analysis (LSD) was utilized to examine any further differences across the groups. The findings showed that there was a significant difference in the mean gain scores on the physics achievement exam between the students with varying achievement levels, as indicated by F (2, 84) = 54.621, p = 0.000 less than 0.05 and a moderate effect size η^2= 0.434 and 0.565 approximately 0.525. The post hoc test (LSD) was utilized to investigate any additional differences between the groups.

Table 9. Post hoc (LSD) Test.

Achievement level (I)	Achievement level (J)	Mean Difference (I-J)	Std. Error	Sig.
High Achiever	Average Achiever	4.43	0.29	.000*
	Low Achiever	7.94	0.27	.000*
Average Achiever	Low Achiever	3.50	0.24	.000*

*p<0.05

Table 9 shows that, the excellent infer difference (4.43), with a p-cost 0.000 less than 0.05, indicates that high achiever students performed better than average achievers in the experimental companies. Similarly, the effective mean difference (3.50) with p-cost 0.000 less than 0.05 indicates that students from high performers in the experimental enterprises performed considerably better overall than students from poor achievers. P-cost 0.000 less than 0.05 and a spectacular suggest difference of 7.94 indicate that high achiever students performed better than poor achiever students.

Table 10. Achievement level wise number of students in the groups.

Achievement level / groups		Value Label	N
Groups	1	Control Group	82
	2	Experimental Group	87
Achievement Levels	1	High Achiever	37
	2	Average Achiever	53
	3	Low Achiever	79

Table 10 shows that there were 82 and 87 students placed in the control groups and experimental groups and 37, 53 and 79 in all three categories were high, average and low achievements correspondingly.

Table 11. A two-way ANOVA was used to analyse achievement levels in the experimental and control groups.

Source	Type III Sum of Squares	df	Mean Square	Partial Eta Squared (η2)	F	Sig.
Group	853.074	1	853.074	.404	110.373	.000
Achievement Level	581.807	2	290.904	.316	37.638	.000
Group * Achievement Level	279.606	2	139.803	.182	18.088	.000
Error	1259.834	163	7.729			
Total	13110.000	169				
Corrected Total	3445.598	168				

R Squared = .369 (Adjusted R Squared = .350)

Table 11 depicts that high achiever ($mean = 16.3$) so fared surprisingly better than average achievers ($imply = 7.8$) and low achiever of 10th grade students'($imply = 10.8$). Academic success is shown in Table 11 with a $F\ value\ of$ 18.08 and df= 2 at $p - value$ 0.000 less than 0.05, indicating the existence of an interaction influence between teaching/mastering technique and level of achievement.

Gender wise Analysis within Experimental Groups

After analyzing the achievement level between the groups, now the gender wise analysis of experimental group students' is being presented as follows.

Table 12. Gender wise comparing mean gain achievement scores.

Gender	N	Mean	SD	t	df	p-value	Effect Size
Male	47	8.78	4.60	3.52	85	0.000	0.83
Female	40	11.97	3.84				

*p<0.05

Hence, the greater effect size of Cohen's d cost= 0.83 > 0.8 indicates that female students in the experimental organizations who had higher mean gain ratings (M=11.97 and SD=4.60) were more likely to win than the male students (M=8.78 and SD=3.84) who were under the 7 E academic model. Table 12 shows that, as indicated by t (85) = 3.52, df = 85, and p = 0.00, there is a significant difference in the suggest advantage scores in physics achievement exams between male and female students in experimental organizations.

Table 13. Comparing male and female higher achievers' mean gain achievement scores.

Gender	N	Mean	SD	T	df	p-value	Effect Size
Male	13	11.75	1.03	6.02	18	0.000	1.63
Female	07	5.70	2.67				

*p<0.05

Consequently, it can be inferred that high achiever male students in the experimental groups had higher mean benefit ratings (M=11.75 and SD=1.03) than did high achiever female students (M=5.70 and SD=2.67) when using the 7E instructional model, as indicated by the larger effect length of Cohen's d value = 1.63 > 0.8. Table 13 shows that, as indicated by t (18) = 6.029, df = 18, and p = 0.00, there was a significant difference considered in suggest benefit evaluations in the physics accomplishment test between high achiever female and male students covered by experimental agencies.

Table 14. Comparative analyses of male and female average achievers' mean gain achievement scores.

Gender	N	Mean	SD	t	df	p-value	Effect Size
Male	10	3.55	1.51	3.70	24	0.000	0.96
Female	16	7.81	2.93				

*p<0.05

Table 14 indicates that there was a significant difference in the implied advantage rankings in the physics achievement test between male and female average achiever students of the experimental groups, as indicated by $t\ (24)\ =\ 3.70, df\ =\ 24$, and value of p is equal to 0.00. Consequently, it can be inferred that average female students in experimental companies had a higher mean advantage rating ($M\ =\ 7.81\ and\ SD\ =\ 2.93$) than average male students ($M\ =\ 3.55\ and\ SD\ =\ 1.51$) taught using the 7E model, as indicated by the larger effect size of $Cohen's\ d\ =\ 0.96\ >\ 0.8$.

Table 15. Comparing male and female low achievers' mean gain achievement scores.

Gender	N	Mean	SD	t	df	p-value	Effect Size
Male	24	11.08	2.62	6.35	39	0.000	1.01
Female	17	16.26	2.46				

*p<0.05

Table 15 illustrates how the difference in mean advantage scores in the physics achievement test between male and female low achiever secondary students inside experimental groups became substantial, as indicated by t (39) = 6.35, df = 39, and p-cost equal to 0.00. This is supported by the large effect size of Cohen's d value = 1.01 > 0.8. Therefore, it can be inferred that low achiever female students in the experimental organization had a higher mean advantage score (M = 16.26 and SD = 2.46) than low successful male students (M = 11.08 and SD = 2.62), who were treated with the 7E academic model.

CONCLUSION AND DISCUSSION

The research used a "quasi-experimental design" to examine the impact of the constructivist 7E educational paradigm on the physics academic success of secondary school students. However, Table 1 presents an analysis of the hypothesis regarding the impact of the 7E instructional model on the achievement score of Physics students in "public secondary schools". The consequences show that students instructed using the 7E instructional strategy had a higher mean score (Mean = 10.03) compared to students instructed using traditional methods, who had a lower mean score (Mean = 4.70). A significant value (p > 0.000) was found when the findings were analysed using the independent samples t statistics. Accordingly, the results of this study demonstrated that the 7E approach of educational technique had a beneficial impact on students' physics performance in public schools. Therefore, 7E instructional model offers the students the opportunities to participate actively in the process of learning and show progress in their reasoning abilities within the classroom during a mutual discussion with peers, cross-questioning with the teacher, and thinking and rethinking about an idea for seeking a solution of the problem. According to the constructivist approach, students gained their own understanding through active engagement by being exposed to the situation. This experience stimulates the brain's cognitive aspect and produces an increased process of thinking and rethinking (Eisenkraft, 2003).

The present study's results are consistent with those of Gok (2014), who found that the 7E teaching technique improves students' grades by helping them better intellectualize and comprehend the science process abilities and the human body system. It is also evident that 7E instructional model of the constructivist approach significantly influences the learning outcomes because several phases i.e., (seven) of this model develop students' thinking power so that learning becomes expressive and students learn to

construct their own knowledge through the different phases (Marfilinda et al., 2020). It enhances students' creativity, peer collaboration, and problem-solving self-assurance, all of which support instructional success. Unlike traditional methods wherein students are involved in the getting to know system, students are given the possibility to take part. Later results of this have a look at have been also confirmed by Shaheen and Kayani (2015), they found that 7E teaching techniques is an effective method to improve students' performance and enhance their meaningful understanding, thereby encouraging them to offer causes for complicated conditions. Furthermore, this result also supports the finding of Githae et al. (2015) explored that 7E approach fosters students' attitudes towards science subjects and enhances the educational performance of secondary students in term of cognitive and effective ability in the subject of biology. Similarly, the finding of this study also support the results of Iqbal et al. (2022) found that 7E model had a significant impact on students' deep learning and enhanced their higher-order thinking ability among the 10th grade students. Additionally, Okafor (2017) stated that the teaching cycle can enhance students' reminiscence capability as compared to standard coaching techniques. The mastering cycle displays the social and personal nature of knowledge advent, which makes know-how easier to keep in mind. The rationale for this examination is that such remarks can help students pass exams. In particular, the 7E levels of "elaborate," "give an explanation for," and "provide an explanation for" have been located to have the best impact on students' attitude. Students recognize the opportunity to increase their conceptual understanding of the subject of physics and solve their routine life problems.

IMPLICATIONS AND SUGGESTIONS

Much research has shown that the usage of 7E model based totally coaching in education increases secondary school students' success, it allows them to preserve their getting to know and improves their information in keeping with the teaching model. Additionally, Miadi et al. (2018) showed that 7E model has a wonderful impact on students' aptitudes. In addition to enhancing questioning and thinking skills, it also enables improve students' attitudes toward mastery of learning (Adak, 2017; 2015; Gok, 2014; Mecit, 2006; Naade et al., 2018; Siribunnam & Tayraukham, 2009; Shaheen & Kayani, 2015; Sornsakda et al., 2009). However, Turgut et al. (2017) found that students' academic achievement rated higher when taught using the 7E method. In a similar vein, Bozorgpouri (2016) demonstrated how the 7E educational strategy greatly impacted students' academic progress and learning. Additionally, it can help students in various ways and improve their attitude toward scientific courses. In a similar vein, Balta and Sarac (2016) suggested that teachers "should be encouraged to incorporate this approach into their teaching, given the high effect of the 7E strategy in science teaching, and to progressively customize it into their own personalized learning style."

This method improves students' performance as well as their cognitive ability, critical and analytical thinking skills, and attitude toward science. It also adds enjoyment to studying. The Elicit level is crucial for triggering students' past knowledge so they can build on it effectively, but in a typical study space, it is impractical for an instructor to tailor the material to each student's past knowledge within the allotted time frame. Numerous studies have demonstrated the superiority of the 7E educational paradigm over conventional teaching techniques. The model's implementation does, however, have certain restrictions. In addition, students require adequate time to do assignments, engage in group discussions, and expand their knowledge of building blocks of concepts. Drawing from a variety of research studies and the advantages of the 7E mastering cycle version, the researcher came to the conclusion that this model will prove to be highly advantageous for students as well as for curriculum developers, in-service teachers, and future educators. The timely completion of the syllabus and the curriculum's structure and content limit the application of the version. Instructors usually waste time organizing and planning lessons only using this teaching strategy. It also becomes problematic and difficult to create a lively, supportive environment for students if the instructor isn't always proficient in enforcing constructivist techniques. The study suggests that in order to improve the effectiveness, significance, and enjoyment of the educational system, teachers should review and readily adopt the 7E model of their curriculum. Secondary school students who

actively participate in their education and are motivated to study may benefit from the use of the constructivist 7E academic model by their teachers in the classroom. For the concept to be implemented successfully, there should be widespread training for both pre-service and in-service teachers. Teachers can also be given lesson plan templates that have been prepared using the 7E approach, which they can then adjust to meet the needs of their students and the requirements of the subject, thus saving valuable teaching time. More strategies must be developed in order to fully reap the rewards of this successful teaching and learning approach. The government and officials have to step up and offer teachers and students all the assistance and educational tools they need.

Suggestions for Further Studies

Some agencies such as the National Institute of Technology and Scientific, Islamabad, which work to promote science education at the national level may develop and perform a further longitudinal and experimental investigation on the applicability of the constructivist 7E learning model.

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