An Example for the Effect of 5E Model on the Academic Success and Attitude Levels of Students': "Inclined Projectile Motion"

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ABSTRACT

In this study, the effect of the lessons applied in the subject of Inclined Projectile Motion, by taking the 5E Model as basis, in the Physics lesson of GATA Noncommissioned Health Officer Preparation School's 1st grade, on students' academic success and attitude levels was investigated. The study was carried out on 84 students studying in GATA Noncommissioned Health Officer Preparation School's 1st grade on 2004-2005 spring semesters. In the study, multiple choice success test and attitude scale were used. At the analysis made at the end of the application, it was concluded that the experimentation group students on which the 5E Model had been applied were more successful than the control group students on which traditional method had been applied, and that they developed more positive attitudes towards the subject. In light of the findings obtained at the end of the study, recommendations were made.

Keywords: 5E Model; Physics Education; Inclined Projectile Motion.

INTRODUCTION

In the past, a well-informed man was the one who knew everything or who stored the information produced by others in his brain. For this reason, education in the previous centuries was mainly seen as conveying present knowledge, cultural values and vital skills to the newly growing generations. Today, however, a well-informed man is the one who is aware of the knowledge, knows the ways to reach this knowledge, learns the reached knowledge by giving meaning to it, can produce new knowledge from the learned knowledge and can use the knowledge he produced in problem solving. Then, human brain is not a place where the learned knowledge is stored one on the top of other; on the contrary, it should be an active strategy center.

The new aim of the education is to form a human model who knows how and where to use the knowledge, recognizes his own learning methods and uses it efficiently, and

benefits from previous knowledge in producing new knowledge (Nuhoğlu, 2004). And this is only possible through individuals who learn learning, who do research, and who are creative.

Developments in science and technology direct almost every phase of our lives. Science is the field where the principles of science and technology are taught. Science and technology education is the ground for a good education. Thanks to the education of science lessons, people are developing mentally and in terms of creativity. Therefore, modern theories should be applied in science teaching (İşman et al, 2002). To this end, countries are striving for developing their science teaching programs, increasing the quality of the instructors and equipping educational institutions with instruments (Özmen, 2004). Seeing that implementers of science and technology education programs in schools are instructors, it is crucial that they be trained as possessing modern knowledge, skills and attitudes, that they are aware of the new learning-teaching approaches and theories used in science education (Özmen, 2004). All these requirements are the forerunners of remarkable innovations for the education systems which are expected to train the experts of the future. This situation entrusts critical tasks to all educational institutions.

A good science instructor is defined as the one who clearly comprehends what science is, what its nature is related to and how it has developed. For this reason, instructor candidates need to comprehend these concepts before starting their profession (URL–1).

Through an efficient science teaching, the student first likes the lesson, becomes active during the lesson, and takes the joy by doing and experiencing the lesson. The student makes observations, does research and experiments, discovers and finds the information on his own or her own, interprets the information found, suspects the information learned, establishes a relation between previous experience and daily life, applies the information learned, shapes his/her life by the information learned and solves problems he/she confronted with. The student improves self control, can express and defend his/her opinion, decide, and take responsibility, participates in group studies, shares information, and learns acquiring some information and thinking, it during his life. Time is spared also for slow learners and gifted students. While performance of the student who is hyperactive, who suffers from lack of concentration or has difficulty in understanding science lessons is increasing, the interest of the one who is interested in or curious about science lessons strengthens, thus specializes in whatever field he/she wants. The student's negative attitude in and out of the class diminishes (Can, 2004).

Recently, some of the models which are being used in the education-teaching process with different transaction steps are based on constructivist learning theory. Generative model which was developed by Wittrock and Ayas introduced in four phases, 5E and 7E Models that examine activities in five and seven different steps, and the model which was developed towards the phases of constructivist teaching by Driver and Oldham (1986) can be given as examples. One of the most useful forms of this theory that is used during the teaching process is the 5E Model which is developed by Bybee, who is among the innovators of BSCS (Biological Science Curriculum Study) and which consists of five steps (Keser, 2003).

5E Model enables learning a new concept or trying to understand a concept that has been known in depth. It includes skills and activities that increase curiosity for research, satisfy student's expectations, and make the student focus on an active research for information and understanding. Students use their previous knowledge in discovering new concepts for the concepts to gain a meaning. 5E Model is the model which is based on research oriented constructivist learning theory and experimental activities. 5E Model,

while including students in activity at every phase, encourages students to constitute their own concepts (Martin, 2000). The model is composed of five steps. These are; Engage, Explore, Explain Elaborate and Evaluate (Carin & Bass, 2005). 5E Model is built up on the results of the researches determined at National Science Education Standards (Newby, 2004).

5E Model, since it was put forward by Rodger Bybee in 1997, has been the subject for many researches; it has not only been applied in science fields but also in social fields. In his study about this subject, Sökmen (1999) expressed that 5E Model might also be applied in education of social fields, and that it was a method which turns education into a funny pursuit as well as ensuring learning. Using 7E Model, a derivative of 5E Model, which was developed based on constructivist approach, Çepni et al., (2001) prepared material covering up physics, chemistry and biology. The science instructors whose opinion concerning material was asked stated that the current education system forced students to memorize, there was not enough material for the activities within the book, and 7E Model would affect learning positively. Moseley and Reinke (2002) used activities based on 5E Model in their activities. In activities, students developed their own stickers and cartoons to alter people's attitudes about environmental issues. In their study, Keser and Akdeniz (2002) stated that 5E Model was one of the best known models among the ones that were recommended for the constructivist learning theory. In this study, a survey named CLESAF (Constructivist Learning Environment Survey According to 5E Model) was developed towards defining and evaluating learning methods designed in accordance with 5E Model. In his doctorate thesis study, Keser (2003) designed and applied an constructivist learning medium in accordance with 5E Model about Electromagnetic Induction for high school 2nd class considering the factors that affect traditional physics learning media. At the end, notwithstanding the difficulties in realising the expected changes due to the factors that shape activities in traditional physics classes, it was concluded that the constructivist learning medium design model developed by this study had a feasable structure to apply. In a study made by Boddy, Watson and Aubusson (2003); a unit study in primary school 3rd grade based on 5E Model was found to be interesting and funny by students. It also developed student's high level thinking ability. This study aimed at giving information on which shapes and class practice and how a constructivist teaching model can be applied. Findings obtained from student interviews have illustrated that the unit study made using 5E Model motivates students to think and learn, and that the activities are interesting and funny. Eisenkraft (2003), in his study, expresses the differences and commons of 5E and 7E Model. In the study of Clark (2003), applications were made using 5E Model. The result of the study was evaluated by students, administrators and student guardians. It was stated that the application requires especially too much time. Newby (2004) made applications based on 5E Model at the level of primary schools. In the study, it was reported that student success increased when students felt more comfortable and experimental activities were integrated into the lessons. Carreno (2004), in his study, used activities depending on 5E Model, he reported benefits of learning with this model through observing student behaviors. Wilder and Shuttleworth (2004) designed a biology lesson content using 5E Model. In the study, each step was studied carefully. Çepni, Küçük and Bacanak (2004), in their study, aimed at determining the criteria for developing material based on constructivist learning approach and preparing a teacher's guide material based on this approach for the subjects of movement and force which are within the science lesson program of 7th grade. At the end, education strategies that are used in different steps of the 5E Model and principles of a model-based science lesson, and from the point of view that students' learning depends on previous

experience, thinking ways that students from different education levels have about movement and force have been put forward based on the literature.

From these results, it was emphasized that students were more active in learning media according to 5E Model rather than teachers; that critical thinking, problem solving, discussing and group work methods and also the social communication that students established among their friends was important for active learning. In the study of Evans (2004), from the point of the view that every student can't be taken care of individually and that attention of each of them cannot be drawn, the issue of "Which attitude or event within the subject to be taught can draw student's attention?" was handled. Answers for the questions of how to motivate students and how to arouse their curiosity were sought. Evans, who prepared and applied a unit about gasses according to 5E Model, has determined that students actively participated in the lesson while the unit is treated, that they took responsibility and that they had fun. Akdeniz and Keser (2004), considering the factors affecting traditional learning media, for the purpose of benefiting in performing the activities about high school physics subjects, made a study towards developing an constructivist learning media model according to 5E Model. In their study, Demircioğlu, Özmen and Demircioğlu (2004) examined the efficiency of applying the activities developed according to 5E Model for the subject of "Factors That Affect the Balance of Solubility", which takes place in high school 2nd grade chemistry program. At the end of the study, the experimental group in which activities according to 5E Model were used was found to be more successful than the control group in which traditional approach was used. Stamp and O'Brien (2005), in their study, collaborated with a school to make 5E Model harmonious with formal curriculum and to improve teaching. While applications were made, information related to students' and graduated students' attitudes towards science education and education activities in class were observed. Balcı (2005), in the master's thesis she submitted, investigated 5E Model conceptual variation texts' and traditional teaching's affects on correcting 8th grade students' misconceptions about photosynthesis and respiration in plants, and the effects of teaching methods on students' attitudes toward science lesson. Results showed that experimental groups are more successful in understanding photosynthesis and respiration in plants than the control group. Education based on both 5E Model and conceptual variation texts proved to be efficient in eliminating the misconceptions that 8th grade students have in photosynthesis and respiration in plants. Saka and Akdeniz (2006), in their study, within the scope of the Biology V (Genetics) lesson that takes part in science teaching's fourth year, developed computer-assisted education materials consisting of animations and simulations prepared on Flash about the subjects of chromosome-DNA-gene concepts, genetic crossing and cloning which teacher candidates have difficulty in understanding and by using these materials within the planned activities according to 5E Model, determined their positive effects on learning.

As it is understood from the studies made, 5E Model contributes positively to students' academic success, their attitude towards the lesson, their developing concepts, development of their cognitive structures. Nevertheless, when researches made on science teaching in our country are considered, it is seen that the researches testing the efficiency of 5E Model are limited in number. For this reason, in primary and secondary education science lessons, for the academic success levels of the students to increase and for learning to be permanent, there is need for scientific researches testing efficiency of 5E Model to be done. Starting point of this research is this necessity.

AIM AND METHODOLOGY

In this study, necessary lesson documents based on 5E Model have been prepared and application been conducted. In this study, while 5E Model was applied, the groups were occurred in order to enhance the interaction and competition among the students. Various activities were performed in these groups. The demonstrations including visual and auditory imaging, situational trials and vital examples were shown and were performed. It was provided that the students investigated these matters by giving them as homework. All the activities done aimed at putting forward the lesson to provide the explanation of Inclined Projectile Motion efficiently by preparing lesson notes previously according to a plan. An answer to the question of "How this lesson and activities affected students' academic success and attitude?" was sought because students' attitude towards the lesson and subject is quite important in terms of learning the subject told. Attitude is related to dealing with the emotions arising during learning and taking them under control and it has a significant role in directing human behaviors. The attitudes that are developed in connection with a value and belief system, their being negative or positive directly affects learning period and directs individuals' future lives (Seferoğlu, 2004).

It has been thought that the experimental and control groups were affected from the uncontrollable outer effects equally. Experimental and control group students' presence levels have been assumed to be equal. Students, while answering the questions, sincerely reflected their real skills, sincerity, emotions and thoughts. Some factors that are overlooked in the transactions made during matching students within the experimental and control group are found to be at a level that won't affect research findings and results. It has been assumed that the present in the lesson of the students of experiment and control groups have been in the same level. Subjects' teaching method and scope have been assumed to be same in both classes and lessons were treated by the same teacher.

This research was conducted with 84 cadets of high school 1st grade who were being educated in 2004-2005 education-teaching year. Research is only limited to Inclined Projectile Motion. Research is applied at the Inclined Projectile Motion subject in physics lesson. 44 of the students formed the experimental group and 40 formed the control group. The lesson was treated according to 5E Model in experimental group and according to traditional method in the control group.

Experimental pattern of the research is the one with pre-test post-test control group and is a semi experimental pattern. The tests that were applied to the experimental and control group students on whom applications were carried out before and after the experimental transaction may be seen at Table 1.

Table 1. *Experimental Pattern of the Research*

Group	Pre-Test	Experimental Transaction (Application)	Post-test
Experimental Group	T_1, T_2, T_3	5E Model	T_1, T_2
Control Group	T_1, T_2, T_3	Traditional Method	T_1, T_2

T_1 : Inclined Projectile Motion Multiple Choice Success Test (IPMMCST),
T_2 : Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM),

T_3 : Test for Reasonable Thinking Ability (TRTA).

Inclined Projectile Motion Multiple Choice Success Test (IPMMCST) which was prepared by the researcher to measure academic success levels of the students towards Inclined Projectile Motion, Test for Reasonable Thinking Ability (TRTA) to see students' problem solving skills and group equivalence, Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM) which was developed by the researcher to measure students' attitude and interest in Projectile Motion were used as data collecting tools.

Inclined Projectile Motion Multiple Choice Success Test (IPMMCST) was formed by the researcher after having scanned many source books from primary school level to university levels for a long period, and selecting questions from the subjects appropriate to the scope. Inclined Projectile Motion Multiple Choice Success Test (IPMMCST) of 27 questions whose validity and trustworthiness had been determined was applied to the students. The test in question was composed of 30 items at first. While the test was being prepared, the questions based on knowledge were chosen predominantly, for which one formula or memorized knowledge was not sufficient. All of the questions prepared were revised; choice number was prepared as five for all questions. For validity of the tests, expert's opinion was taken and validity of the test was determined with expert's opinion, and passed to experimental application for trustworthiness. Test, for this purpose, was used on another Military High School's, which is a similar school to the one the application was made on 01 MARCH 2005 and which accepts students according to the results of Military High Schools and Noncommissioned Officer Preparation Selecting Exam, 1st grade students of 2004-2005 education-teaching year. According to the data obtained, item analysis was made and 27 questions over 30 were determined to be perfect and in good quality, but 3 questions to be weak. At the end of the trustworthiness analysis made, the test's trustworthiness was found as (0.88). At the end of experimental application, the test's 27 questions that convinced to be appropriate for the purpose were applied to the experimental and control group students before and after the experimental application. The aim of this test is to reveal differences at cognitive levels among the groups that may result from the different methods which were applied to the experimental and control groups by checking out students' knowledge and learning level of Inclined Projectile Motion as Pre-Test and post-test. Tests developed to achieve these purposes are in tracking quality. Tracking tests are the ones that give information to the teacher and student about the course of the learning.

The Test for Reasonable Thinking Ability of 10 questions is a test that measures the abilities of defining and controlling variables, proportioning, developing relation, accounting and uniting probability. Original of this test was developed by Kenneth G. Tobin and William Capie and prepared to determine students' thinking ability (Ünal, 2003). Their translation to Turkish was made by İ. Özkan, P. Aşkar and Ö. Geban (Geban, 1990).

Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM) was also prepared by the researcher. The scale, which was applied to both the experimental and the control groups before and after the application to measure students' attitudes towards the one used in the research and Physics lesson Projectile Motion subject, is a likert type measuring tool developed by the researcher. Questions in the attitude scale was formed by modifying and organizing the questions in physics attitude scale prepared by Abak (2000) and some of the attitude test questions in the master's thesis prepared by Taşlıdere (2002) to measure students' attitudes towards electricity circuits to the subject of Projectile Motion. The scale that was prepared by organizing these questions and adding additional questions was composed of 61 items. The attitude determining scale prepared on the subject of Projectile Motion after having an expert's opinion; and experimental application

was passed for trustworthiness. This scale of 61 items was applied on another Military High School's, which is a similar school to the one the application was made on 04 MARCH 2005 and which accepts students according to the results of Military High Schools and Noncommissioned Officer Preparation Selecting Exam, 1st grade students of 2004-2005 education-teaching year. The data's trustworthiness which was obtained from this Pre application was determined by analyzing through statistics packaged software. The minimum point that can be taken from the attitude scale used was 61, the highest one is 305. At the end of the experimental application, the trustworthiness coefficient of this test composed of 61 questions is (0.90). This coefficient is evaluated as a scale with a high trustworthiness in the field of social studies. Attitude determining scale for the subject of Projectile Motion was made to determine whether the students in experimental and control groups would get the same points before starting the application, and was made to contrast different methods' effect on the attitude points towards the subject of Projectile Motion in the experimental and control groups after the application.

T-test among statistical analysis methods was applied to the data obtained to test whether there was the difference between IPMMCST and ADSSPM points of the students.

FINDINGS

In this part, the data obtained as a result of data collecting tools were analyzed. Before teaching, the findings belonging to the results of test for Reasonable Thinking Ability which was applied to the experimental and control groups are presented in Table 2.

Table 2. *Independent Groups t-Test Results Related to the Experimental and Control Group Students' TRTA points*

Test	Group		$\overline{X}$	s	sd	t	p
TRTA	**Control**	40	17.750	1.904	82	.467	.642
	Experimental	44	17.909	1.157			

According to Table 2, two average point values are fairly close to each other. Whether the difference between these averages are statistically meaningful or not is checked out by the t-test for independent groups, according to calculated t value and meaningfulness level ($p<0.05$), no meaningful difference was observed between groups.

A-The Findings and Interpretations Obtained from Success Test before Experimental Transaction

t-Test results before experimental transaction for IPMMCST are seen in table 3.

Table 3. *Independent Groups t-Test Results Related to IPMMCST Pre-Test Points*

Measurement	N	$\overline{X}$	s	sd	t	p
Pre-Test (Control)	40	10.000	3.281	82	.888	.377
Pre-Test (Experimental)	44	9.386	3.028			

When Table 3 is examined, it will be seen that two average point values are quite close to each other. Whether the difference between these averages are statistically

meaningful or not is checked out by the t-test for independent groups, according to calculated t value and meaningfulness level ($p<0.05$), no meaningful difference was observed between groups.

B- The Findings and Interpretations Obtained From Success Test After Experimental Transaction

t-Test results before experimental transaction for Inclined Projectile Motion Multiple Choice Success Test (IPMMCST) is seen in Table 4.

Table 4. *t-Test Results Related to IPMMCST Post-Test Results*

Measurement	N	$\overline{X}$	s	sd	t	p
Post-test (Control)	40	18.575	3.062			
				82	9.809	.000
Post-test (Experimental)	44	24.272	2.128			

When Table 4 is investigated, it will be understood that two average point values are quite different. Whether the difference between these averages was statistically meaningful or not was checked out by the t-test for independent groups, a meaningful difference between the groups in favor of the experimental group has been detected according to the calculated t value and meaningfulness level ($p<0.05$). According to IPMMCST post-test points, after it was detected that the experimental group was more successful, it was attempted to put forward the relation between the pre test-post test points of the experimental and control groups. Pre test-post test t-test results of the students in experimental and control groups for IPMMCST are seen in Table 5 and Table 6.

Table 5. *Dependent Groups t-Test Results Related to IPMMCST Pre Test-Post Test Points of the Students in Experimental Group*

Measurement	N	$\overline{X}$	s	sd	t	p
Pre-Test (Experimental)	44	9.386	3.028			
				43	23.543	.000
Post-Test (Experimental)	44	24.272	2.128			

When Table 5 is examined, it will be understood that two average point values are quite different. At the end of the t-test analysis for dependent groups, according to the calculated t value and meaningfulness level ($p<0.05$); it has been detected that there is a meaningful difference between the experimental group's pre test-post test points in terms of IPMMCST, which is in favor of the experimental group's post-test points.

Table 6. *Dependent Groups t-Test Results Related to IPMMCST Pre Test-Post Test Points of the Students in Control Group*

Measurement	N	$\overline{X}$	s	sd	t	p
Pre-Test (Control)	40	10.000	3.281			
				39	14.856	.000
Post-Test (Control))	40	18.575	3.062			

When Table 6 is examined, it will be understood that two average point values are quite different. At the end of the t-test analysis for dependent groups, according to the

calculated t value and meaningfulness level (p<0.05); it has been detected that there is a meaningful difference between the control group's pre test-post test points in terms of IPMMCST, which is in favor of the control group's post-test points.

When groups are compared, it is seen that experimental group's IPMMCST pre-test point average is 9.386, and control group's IPMMCST pre-test point average is 10.000. Post-test points, however, of experimental group is 24.272, and of control group is 18.575. As it can be understood from here, although there is no difference at the pre-test points of the groups, there is a big difference at the post-test points in favor of the experimental group.

C- The Findings and Interpretations Obtained From Attitude Scale Before Experimental Transaction

The relation between the Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM) points of the experimental group students for whom the lesson was designed and treated according to 5E and of the control group students for whom traditional education was applied, before and after the experimental transaction, is explained below.   T-test results before the experimental transaction for the Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM) is seen in Table 7.

Table 7. *Independent Groups t-Test Results Related to ADSSPM Pre-Test Points*

Measurement	N	$\overline{X}$	s	sd	t	p
Pre-Test (Control)	40	222.900	34.267			
Pre-Test (Experimental)	44	228.545	26.819	82	.835	.406

When Table 7 is examined, it will be understood that two average point values are quite different. Whether the difference between these averages were statistically meaningful or not was checked out by the t-test for independent groups; no meaningful difference between the groups has been detected according to the calculated t value and meaningfulness level (p<0.05). The fact that there had been no meaningful difference between students' attitude towards the subject of Projectile Motion before the experimental began is in accordance with the purposes of the study.

D- The Findings and Interpretations Obtained From Attitude Scale after Experimental Transaction

The t-test results for ADSSPM after the experimental transaction are seen in Table 8.

Table 8. *Independent Groups t-Test Results Related to ADSSPM Post-Test Points*

Measurement	N	$\overline{X}$	s	sd	t	p
Post-Test (Control)	40	237.350	34.207			
Post-Test (Experimental)	44	252.295	22.596	82	2.338	.022

According to the Table 8, two average point values are different. Whether the difference between these averages was statistically meaningful or not was checked out by the t-test for independent groups, a meaningful difference between the groups in favor of the experimental group's post-test points has been detected according to the calculated t value and meaningfulness level (p<0.05).

After determining in that way that the experimental group's attitude points were higher according to the experimental and control group's Attitude Determining Scale for the Subject of Projectile Motion (ADSSPM) post-test points, it was attempted to put forward the relation between the pre test-post test points of the experimental and control groups.

Table 9. *Dependent Groups t-Test Results Related to ADSSPM Pre Test-Post Test Points of the Students in Experimental Group*

Measurement		$\overline{X}$	s	sd	t	p
Pre-Test (Experimental)	44	228.545	26.819			
Post-Test (Experimental)	44	252.295	22.596	43	10.157	.000

When Table 9 is examined, it will be understood that two average point values are quite different. At the end of the t-test analysis for dependent groups, according to the calculated t value and meaningfulness level ($p < 0.05$); it has been detected that there is a meaningful difference between the control group's pre test-post test points in terms of ADSSPM.

Table 10. *Dependent Groups t-Test Results Related to ADSSPM Pre Test-Post Test Points of the Students in Control Group*

Measurement	N	$\overline{X}$	s	sd	t	p
Pre-Test (Control)	40	222.900	34.267			
Post-Test (Control)	40	237.350	34.207	39	6.136	.000

When Table 10 is examined, it will be understood that two average point values are quite different. At the end of the t-test analysis for dependent groups, according to the calculated t value and meaningfulness level ($p < 0.05$); it has been detected that there is a meaningful difference between the control group's pre test-post test points in terms of ADSSPM, which is in favor of the control group's post-test points.

When groups are compared with regard to their pre-test points, experimental group's ADSSPM average is 228.545, and control group's ADSSPM average is 222.900. Post-test points, however, of experimental group is 252.295, and of control group is 234.350. With reference to this, although there is a very small difference at the pre-test points of the groups, there is a difference at the post-test points in favor of the experimental group.

RESULTS AND SUGGESTIONS

A-Results

1. Although there is no difference at the Inclined Projectile Motion Multiple Choice Success Test IPMMCST pre-test points of the experimental and control groups, a big difference at the post-test points in favor of the experimental group was observed. With reference to this, it can be said that the 5E which was used in teaching the subject of bent down shot has been more successful than the traditional methods.

2. There was the significant difference between the IPMMCST points applied in pre and post study in the experiment group which the lesson was performed according to 5E Model. When obtained results are considered, it is seen that this difference is in favor of post-test points. Results show that the students who were in the experimental group where 5E model was applied were more successful at the post-test.

3. A meaningful difference was observed between the post-test points applied to the students in experimental and control groups at the end of the study period. That is to say, 5E Model caused the attitudes of the students to be more positive compared to the traditional method.

4. It was seen that, in the experimental group where the lessons were taught according to 5E, there was a meaningful difference between the pre test-post test data obtained from students' attitudes towards the subject of Projectile Motion. It was detected that after the application period of the students in the experimental group, their attitude points towards the subject of Projectile Motion were higher than it had been at the beginning of the process.

5. In the control group where the traditional method was used, at the end of the application period, it was seen that there was a meaningful difference between the pre test-post test data obtained from their attitudes towards the subject of Projectile Motion. It was detected that after the application period of the students in the control group, their attitude points towards the subject of Projectile Motion displayed a small difference compared to the points at the beginning of the period.

As it will be seen, the results obtained are parallel to the related literature.

B- Suggestions

1. 5E Model can easily be applied by adapting education programs into 5E Model in state and private educational institutions. Nevertheless, especially in primary and secondary educational institutions connected to N.M.E. and higher education, applying 5E Model successfully is only possible by providing sufficient and necessary infrastructure, technical equipment, documents and materials. Instead of complex, expensive tools, tools which are simple, cheap, and can be found easily should be preferred. Moreover, so as for these materials to be used by all students, they should be made available in all schools as sources such as books, websites, CDs, and so on. Unless such preparations are made, applying this model will be difficult and desired results won't be achieved.

2. The correlation between the subjects taught in Science and especially Physics lessons and daily life is very important. If the subjects are not supported with vital examples, they are forgotten in a short while and arouse less interest and curiosity. In the lessons which are taught according to 5E Model, giving examples about the subject from daily life and wanting similar examples from the students not only encourages students to do researches but also enables founding a relation between the daily life and taught subject. Through vital example applications and relating the subject with its daily usage will ensure students' more enthusiastic and loving participation towards the science and physics lessons which are approached with fear.

3. When making evaluations for the lessons taught according to 5E Model, students should be evaluated with all the events they performed as a whole. Again, to test what they learned during the lesson and let them see their deficiencies, evaluation questions from all subjects should be addressed in written and verbally, solving those questions individually and in groups should be ensured. Especially in understanding the subject and solving in class practice questions, performing this application is seen as useful.

4. The fact that determining students' knowledge before education is important enough for the education activities to be planned should never be ignored. Nonetheless, many teachers working in schools are either unaware of this or are not informed enough about different methods to detect pre knowledge or mistakes. 5E Model will ensure that all these Pre knowledge and misconceptions be put forward at the first steps of applying the model and taking necessary precautions in the light of this information.

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