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Full Length Research Paper

Comparison of the effects of constructivist learning on cognitive, affective and psychomotor fields applied in physical education courses

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ABSTRACT

The aim of the study is to compare the effect of constructivist learning applied in physical education courses with concerning cognitive, affective and psychomotor domains on experimental and control groups. The experimental research method was used in the study. The study group consisted of 97 students consisting of 34 middle and 63 high school students, 52 of whom were in control and 45 of whom were in experimental group. The cognitive, affective and psychomotor field competencies of the students were determined and compared with the determined scales after applying one semester in the introduction and evaluation parts of the courses, conducted with constructivist learning. As a data collection tool; for cognitive domain; the cognitive information form prepared by the researcher, for affective domain; “Physical Education Course Attitude Scale for Secondary School Students" and “Attitude Scale for Physical Education lesson” for psychomotor domain; the application exam scale developed by the researcher were used. In the analysis of data; due to lack of normal distribution of data, Mann Whitney U, one of the non-parametric tests was used to analyze the differences in cognitive, affective and psychomotor domains of the groups after the application. According to the obtained data; a significant difference was found in favor of the experimental group according to the variable of experimental and control groups in the cognitive and psychomotor domains of the students. In the affective areas of the students, while there was no significant difference between middle school students in terms of experimental and control group pre-test post-test data, a significant difference was found in the control group data in high school students.

Keywords: Physical education, physical education and sports lesson, affective domain, cognitive domain, psychomotor domain, constructivist learning.

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INTRODUCTION

Many of the effective, productive, attractive practices are based on fundamentally solid learning theory. It is possible to frame this learning theory as a model or system covering some generalizations and principles about how individuals learn in the light of long and detailed research. In general, every learning theory has also assumptions that include a philosophical understanding of what knowledge and cognition are. For that reason, the subjects, like teaching objectives, content regulation, implementation of teaching and assessment scales, transmit the chosen learning theory or the philosophical view underlying the theory. Teachers need to know the theories closely which analyze the learning from different dimensions and sometimes opposed to each other to solve the problems that arise during the teaching practices prepared by themselves (Deryakulu, 2000).

Constructivism, which is the favored system in today's education, has emerged as a concept of what is the nature of knowledge. Constructivism is not a theory about

how teaching should be carried out, but a theory of how knowledge and learning should be. Initially, it emerged as a theory of how learners learn knowledge, and gradually developed into an approach to how learners construct knowledge (Demirel, 2002).

In the constructivist approach, learner-centered education is prioritized instead of teacher-centered, and the emphasis is placed on developing mental skills rather than learner's behaviors. In education processes, instead of one-way thinking and straight logic, multi-faceted thinking, questioning and spiral logic are emphasized with this approach, there have been significant changes in the definition of learning and education, principles, curriculum, measurement and evaluation, classroom management, teacher roles, school management, supervision and guidance (Açıkgöz, 2004).

From this point of view, the effects of constructivist learning applied in the introduction and evaluation part of the physical education lessons on cognitive, affective and psychomotor domains were tried to be determined. Accordingly, the answers to the following questions were sought:

1. Is there a significant difference between the control and experimental group variables on the cognitive domain of constructivist learning applied in the introduction and evaluation sections of physical education lessons?
2. Is there a significant difference between the control and experimental group pre-test and post-test variables on the affective domain of constructivist learning applied in the introduction and evaluation sections of physical education lessons?
3. Is there a significant difference between the control and experimental group variables on the psychomotor domain of constructivist learning applied in the introduction and evaluation sections of physical education courses?

It is very important for the teacher to plan instructional activities in the context of constructivist learning in the process of introduction and evaluation sections of physical education courses. Inclusion of the learner in the learning process, gaining critical thinking, discovering, analyzing, interpreting and evaluating skills through constructivist learning are worth researching and important for the permanence of learning.

MATERIALS AND METHODS

Participants

The study group, including 34 middle school students and 63 high school students as an experimental group, consisted of 52 control and 45 experimental group students.

Class variable distributions of 97 students in the study group; As 34 (35.1%) sixth-grade students and 63(64.9%) ninth-grade students, group variable distributions were as follows; 47 (48.5%) of them were the control group and 50(51.5%) of them were the experimental group (Table 1).

Table 1. Study group demographic features.

Variable	Level	N	%
Class	6	34	35.1
	9	63	64.9
	Total	97	100
Group	Control	47	48.5
	Experimental	50	51.5
	Total	97	100

Instruments

Cognitive domain assessment form

For the experimental and control group, two evaluation exams were conducted by using the information form which was prepared by the researcher with the opinion of the expert and aimed to measure the cognitive domain skills.

Affective domain attitude scales

Attitude Scale for Physical Education lesson developed by Karakılıç (2009) was applied to secondary school students during the 11-week application period. The scale consists of 30 attitude items, 15 of which are positive and 15 of which are negative phrases. The lowest score that can be obtained from the scale is 30 whereas the highest score is 150.

These expressions were prepared according to the 5-point Likert scale and expressed starting with “completely disagree” “agree”, “undecided”, “disagree” and “completely disagree”. The reliability coefficient of the scale is 0.96. As the scale was developed for elementary school students aged 12-15, criterion-based validity and construct validity methods were used to determine the validity of the scale. The reliability coefficient of the scale applied to the study group was determined as .87.

For the high school students during the 11-week application process "Attitude Scale for Physical Education Lesson for Secondary School Students" developed by Güllü and Güçlü (2009) was administered. The scale consists of 11 negative (3, 17, 19, 20, 24, 25, 26, 29, 30, 34, 35), 24 positive and in total of 35 items. The scale was designed as a 5-point Likert type and devised as

"(1) Completely Disagree, (2) Disagree, (3) Undecided, (4) Agree and (5) Completely Agree". The lowest score on the scale is 35 and the highest score is 175. The reliability coefficient of the scale was found to be .94. The reliability coefficient of the scale applied to the study group was determined as .91. The scales used for the detection of the affective domain were applied twice before and after the application.

Psychomotor domain evaluation form

Two practice exams for psychomotor domain skills were conducted by using the practice exam scale prepared by the researcher by taking expert opinion for the experimental and control groups.

Design and procedure

In this study which aims to compare the effect of constructivist learning applied in the introduction and evaluation sections of physical education lessons on cognitive, affective and psychomotor domains in the control and the experimental groups, the experimental research model was used to investigate the cause and effect relationships between the variables and to obtain the results quantitatively and transfer them concretely.

Physical education courses were conducted with the experimental group for 11 weeks in line with constructivist learning. In the 11-weeks; the courses of the experimental group were started with the daily plans prepared and the introductory statements created in line with constructivist learning and ended with the evaluation questions that were formed in the direction of constructivist learning. In the control group; for 11 weeks, the direct instruction model was conducted in physical education lessons.

For the cognitive domain; the first assessment exam was conducted at the end of 6 weeks of the instruction period. The content of the exam; consisted of 5 test questions, 1 gap-filling questions consisting of 5 sub-dimensions, 1 true-false expression consisting of 5 sub-dimensions, 3 open-ended questions and a total of 10 questions. The content of the test applied for cognitive field skills included back and forth somersault and hand-head balance in gymnastics, pass types, dribbling and holding the ball in basketball. The exam was scored with 10 points for each question; the gap-filling and right-wrong questions were evaluated from a total of 10 points, 2 points for each sub-dimension. The total exam score was calculated over 100. The second assessment exam was carried out for a further 5 weeks' lessons after the first exam and administered at the end of the fifth week. The content of the exam has the same characteristics as the first exam in terms of the exam questions and the score of it. However, the second exam consisted of topics as service and pass types in volleyball, basic skills and long jump in athletics, ball-racket skills in badminton and shooting in basketball.

For psychomotor domain; the first exam was administered after six (6) weeks of courses, and the second exam was conducted after five (5) more weeks from the first exam. The first practice exam comprised of five topics including front somersault, hand-head balance, hoop, dribbling-holding and pass types in basketball. Each item consisted of five sub-dimensions and was evaluated over 20 points and calculated on a total of 100 points. The second practice exam comprised smash in basketball, finger-cuff pass and bottom service in volleyball, long jump in athletics, ball-racket skill in badminton, and the assessment was done the same as the first exam.

Analysis of data

Descriptive statistical analyses were used in the analysis of the data, and due to non-normal distribution of data Mann Whitney U test was used for the significance of the difference between cognitive, affective, psychomotor domain skills and attitudes before and after the application of the groups.

The basis of the analysis is that the scores do not deviate from the normal margins. If the calculated p-value is less than .05, it can be interpreted that the scores show a significant deviation from the normal distribution (Büyüköztürk, 2005). As shown in Table 2, since the p-value is less than .05, the data of the study do not show a normal distribution.

Table 2. Normal distribution test.

Variables	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Affective Domain	.250	68	.000
Middle School Affective Domain	.141	126	.000
High School Affective Domain	.341	194	.000
Psychomotor Domain	.341	194	.000

*$p < 0.05$.

RESULTS

As shown in Table 3, it was found that there was a significant difference in the cognitive area scores of the students between the first exam scores according to the experimental and control group variables (U = 814,500, p < .05). Taking into consideration the Mean scores it is seen that cognitive area scores of the experimental group (56.21) were higher than the control group (41.33). According to this result; it can be said that constructivist learning lessons affect students' cognitive domain learning more positively.

As shown in Table 4, according to the experimental and control group variables, there was a significant difference between the second exam scores (U = 893,000, p <.05). With regard to mean scores, it is seen that the cognitive area scores of the experimental group (54.64) were higher than the control group (43.00). According to this result; it can be said that constructivist learning lessons affect students' cognitive domain learning more positively.

As shown in Table 5, there was no significant difference found between the attitude scores of the experimental group middle school students according to the pre-test and post-test variables (U = 112,500, p > .05). However, although there is no significant difference, it can be said that there is an increase in the affective domain attitudes of the students after the application.

As seen in Table 6, it was determined that there was no significant difference between the attitudes scores of pre-test and post-test in the affective domain levels of middle school students (U = 152,500, p > .05). On the other hand, although there is no significant difference, it can be said that there is a decrease in affective domain attitudes after the application.

As seen in Table 7, it was found that there was no significant difference between the attitude scores of the high school students according to the pre-test and post-test application variable (U = 554,500, p > .05). It can be said that applied constructivist learning has a positive effect even though there is no significant difference to the experimental group.

As seen in Table 8, it was found that there was a significant difference between the attitude scores of the control group high school students according to the pre-test and post-test variable in affective domain levels (U = 213,500, p < .05). Considering the Means, the pre-test application variable (36.64) of the control group was higher than the post-test application variable (22.36). It can be said that the reason for this is that the courses carried out in accordance with the traditional approach affect students' attitudes towards the course negatively.

As shown in Table 9, there was a significant difference in psychomotor domain skills of the study group students between the first exam scores according to the experimental and control group variables (U = 692,500, p < .05). Taking into consideration the psychomotor domain scores it is seen that the experimental group (58.65) was higher than the control group (38.73). According to this result; It can be said that constructivist learning lessons affect students' psychomotor learning areas more positively.

Table 3. Mann-Whitney U test results of cognitive domain scores according to experimental and control group variables.

Theoretical Exam	Group	N	Mean Rank	Sum of Rank	U	P
I. exam	Experimental Group	50	56.21	2810.50	814.500	.009*
	Control Group	47	41.33	1942.50		

*p < 0.05.

Table 4. Mann-Whitney U test results of cognitive field scores according to experimental and control group variables.

Theoretical Exam	Group	N	Mean Rank	Sum of Rank	U	P
II. exam	Experimental Group	50	54.64	2732.00	893.500	.042*
	Control Group	47	43.00	2021.00		

*p < 0.05.

Table 5. Mann-Whitney U test results of pre-test post-test variables of affective domain attitudes in middle school experimental group.

Group	Application	N	Mean Rank	Sum of Rank	U	P
Experimental Group	Pre-Test	16	15.53	248.50	112.500	.557
	Post-Test	16	17.47	279.50		

p > 0.05.

Table 6. Mann-Whitney U test results of pre-test post-test variables of affective domain attitudes in middle school control group.

Group	Application	N	Mean Rank	Sum of Rank	U	p
Control Group	Pre-Test	18	19.03	342.50	152.500	.763
	Post-Test	18	17.97	323.50		

p > 0.05.

Table 7. Mann-Whitney U test results of pre-test post-test variables of affective domain attitudes in secondary school experimental group.

Group	Application	N	Mean Rank	Sum of Rank	U	p
Experimental Group	Pre-Test	34	33.81	1149.50	554.500	.773
	Post-Test	34	35.19	1196.50		

p > 0.05.

Table 8. Mann-Whitney U test results of pre-test post-test variables of affective domain attitudes in secondary school control group.

Group	Application	N	Mean Rank	Sum of Rank	U	p
Control Group	Pre-Test	29	36.64	1062.50	213.500	.001*
	Post-Test	29	22.36	648.50		

*p < 0.05.

Table 9. Mann-Whitney U test results of the psychomotor domain scores according to experimental and control group variables.

Application Exam	Application	N	Mean Rank	Sum of Rank	U	p
I. Exam	Experimental Group	50	58.65	2932.50	692.500	.002*
	Control Group	47	38.73	1820.50		

*p < 0.05.

As shown in Table 10, it was found that there was a significant difference in the psychomotor domain skills of the study group students between the second exam scores according to the experimental and control group variables (U = 374,000, p < .05). Considering the row average scores it is seen psychomotor domain scores of the experimental group (65.02) were higher than the control group (31.96). According to this result; it can be said that constructivist learning lessons affect students' psychomotor domain learning more positively.

Table 10. Mann-Whitney U test results of psychomotor domain scores according to experimental and control group variables.

Application Exam	Application	N	Mean Rank	Sum of Rank	U	p
II. Exam	Experimental Group	50	65.02	3251.00	374.500	.001*
	Control Group	47	31.96	1502.50		

*p < 0.05.

DISCUSSION

According to the research findings, it was found that there was a significant difference in the cognitive domain between the first and second exam scores according to the experimental and control group variables. In the first

exam, the mean of the experimental group (56.20) was significantly higher than the control group (41.33). Similarly, in the second exam, the mean values of the experimental group (54.64) were significantly higher than the control group (43.00). Accordingly, in the cognitive domain dimension it was found that the experimental group applied with constructivist learning was more successful than the control group.

As a similar result, Erdamar and Demirel (2008) stated that constructivist learning environment has a positive effect on cognitive skills like increasing learners' attitudes towards the courses, being more willing to participate in learning activities, being more confident in themselves, cooperating more, listening to and respecting the views of other friends.

As a result of their study, Özdoğan and Soylu (2004) found a significant difference in favour of constructivist learning theory on the subject achievement test means of the experimental group in which the courses were processed with the worksheets prepared according to the constructivist learning approach and the control group where the traditional method was applied. According to this result; It was determined that the lessons carried out with the worksheets prepared in accordance with the constructivist learning approach, enabling the active participation of the students, increased the success of the students.

In a constructivist learning environment, students should take responsibility for their learning and be aware that their responsibilities will increase if the level of class increases. In this case, an individual who develops and questions his/her repertory of scientific and technological concepts solves his/her problems, discusses them and evaluates learning opportunities outside the classroom may emerge. Therefore, it is necessary to encourage students to think in constructivist learning environments and to provide an environment that develops various solutions to problems. Because gaining different perspectives in solving problems is important in structuring information (Çınar et al., 2006).

In the study conducted by Yurdakul (2004), it was found that experimental curriculum applications designed according to the constructivist learning approach were more effective in developing problem-solving skills than traditional curriculum based applications. In a similar study showing parallelism with the research findings, Koç (2002) found that the constructivist approach contributes to meaningful learning and problem-solving skills development, and is more effective than the traditional approach in developing high-level learning and problem-solving skills.

Budak (2001) and Tümay (2001) observed that the students working with the constructivist approach showed a high conceptual change in line with the answers to the pre-concept and post-concept test. Similarly Kavak (2004) found out that students who had education according to the constructivist learning approach based on role-playing teaching method had less misunderstanding. Correspondingly, Kemankaşlı (2015) stated that the cognitive characteristics of the students studying in the constructivist environment were higher and found that they were more successful in using their problem-solving skills.

According to the findings of another research question, it was found that there was no significant difference concerning affective domain levels of the experimental group middle school students according to the pre-test (15.53) and post-test (17.47) application variables. However, although there is no significant difference, it can be said that the affective domain attitudes of the students increased after the application. In addition, it was found that there was no significant difference in the affective domain levels of the control group middle school students according to the pre-test (19.03) and post-test (17.97) application variables.

While there was no significant difference found according to the pre-test (33.81) and post-test (35.19) application variables of the affective domain levels of the experimental group high school students, significance difference found in the control group students on the pre-test (36.64) and post-test (22.36) application variables.

When the literature was searched, Yurdakul (2004) found a positive increase in the attitude towards the lesson of the group in which the constructivist learning approach was applied, while the traditional approach-based curriculum did not have a positive effect on the attitudes towards the lesson.

In another similar study, Budak (2001) concluded that there was no significant difference between students' attitudes towards science, chemistry, and laboratory with two different teaching approaches (constructivist and confirmatory). In parallel with the research, Tümay (2001) found that there was no significant difference between the pre-test mean scores of the experimental and control groups in both attitude and perception scale.

The positive attitude of a student towards a lesson can provide the academic motivation necessary to succeed in that course. In this case, the student shows interest in the course while participating in the activities of the course. While this interest of the student towards the lesson contributes to the determination of higher objectives related to the course, it provides more effort than other students to achieve these goals (Altınok, 2004).

Based on the conclusion that there is no difference between the groups according to the pre-test post-test variable, it can be argued that the reason for this is that students generally have a positive attitude towards physical education lessons.

According to the research findings, it was found that there was a significant difference between the first and second application exam scores of the experimental group and control group students in terms of the group variable in the psychomotor domain levels. In the first application exam, the mode of the experimental group (58.65) was significantly higher than the mode of the control group (38.73), in the second practice exam, as a

similar result; it was concluded that the mode of experimental group (65.02) was significantly higher than that of control group (31.96). Consequently, it was found that constructivist learning in the psychomotor domain dimension provided more successful development for the students.

In the study of Sarıgöz (2009), which has similar results to this study, it was found that there was a significant difference in conducting an experiment which is one of the psychomotor behaviors between experimental and control groups pre-test post-test scores.

Constructivist learning environments should be organized in such a way as to enable individuals to interact more with the learning environment in which they live and thus enable individuals to have rich learning experiences. Thus, individuals have the opportunity to evaluate what they have learned, correct their mistakes and replace their previous knowledge (Yaşar, 1998). It can be said that with constructivist learning, psychomotor skills provide more meaningful and lasting learning and contribute positively to the success of bringing the desired skill into action.

The results obtained according to the research data are as follows:

- The cognitive domain level of the students showed a significant difference according to the experimental and control group variables. Physical education lessons conducted in line with constructivist learning are positive factors in the cognitive domain level of the students.

- There was no significant difference in the affective domain attitudes of the students according to the pre-test post-test application variable in the control and experimental group of middle school and experimental group of high school. It can be said that the reason for this is that students' physical education course attitudes are generally positive. However, it was seen that there was a significant difference between the pre-test and post-test scores in the affective domain attitude in the high school control group, it can be said that this difference is due to the decrease in the positive attitude of the students who are already present in the physical education lessons in line with the traditional approach.

- Significant differences were found in the psychomotor domain level according to experimental and control group variables. It can be said that in physical education classes implemented with constructivist learning, successful results have emerged in terms of the persistence of psychomotor skills and the transfer of the phases that make up the movement.

RECOMMENDATIONS

Considering the research results, the following recommendations can be made:

- According to the results of the research, since physical education lessons conducted in line with constructivist learning, affect students' cognitive, affective, psychomotor field skills positively, it can be suggested that constructivist learning-oriented planning of lessons can be recommended.

- Again, based on the research results; constructivist learning-oriented planning and implementation may be suggested in terms of permanence of information, learner's relationship with previous and newly learned knowledge, correction of mistakes and realization of meaningful learning.

- Starting from the conclusion that constructivist learning is more effective than behavioral approach in the development of the cognitive domain, it can be suggested that planning and processing of physical education lessons, especially the younger age classes, with a focus on constructivist learning. Again, in line with the results of the research, in terms of meaningful learning and transferring the learned information, constructivist questions may be suggested in the introduction part of the lessons.

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