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The Effect of Distance Education Based on Personalized System of Instructionon Academic Learning Time

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Abstract

The aim of this study was to examine the effect of personalized system of instruction used in the physical fitness unit of online secondary school physical education and sports lesson on academic learning time. The sample of the study was composed of a total of 31 6th graders who attended physical education lesson (experiment group: 15, control group: 16). In the study, data regarding academic learning time were retrieved by using "Academic Learning Time-Physical Education Systematic Observation Tool" which was developed by Parker (1989). Academic learning time was examined over two basic domains including context level and learner involvement level. Lessons were carried out online simultaneously by using personalized system of instruction in the experiment group and direct instruction in the control group. The study findings have shown that personalized system of instruction increases academic learning time significantly compared to direct instruction. While academic learning time was found as 41.99% in the lessons carried out by personalized system of instruction, it was found as 23.93% in the lessons taught by direct instruction. In conclusion, it can be stated that students show appropriate physical activity behavior in 41.99% of their total academic time throughout personalized system of instruction and in 23.93% of their total academic time with direct instruction.

Keywords

Physical education and sports
Personalized system of instruction
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Introduction

Along with the evidence regarding the positive effect of physical activity (PA) on healthy lifestyle, the studies to enhance PA have become more common (Lonsdale et al., 2013; McKenzie, Sallis, Rosengard, & Ballard, 2016; McKenzie et al., 2003).The participation of many students in physical education program at school for years has led to recognize physical education lessons as an ideal environment to encourage regular PA; and the idea that physical education is directly related to health has become widespread (Sallis & McKenzie, 1991). In the following years, Society of Health and Physical Educators America (SHAPE, America) described the purpose of physical education lesson as "developing physically literate individuals who have knowledge, skills and confidence to enjoy lifelong healthy PA" and developed standards for academic physical education programs; and these programs have begun to be used as a guideline in school programs to raise physically literate individuals (SHAPE America, 2013). In parallel to this, current Physical Education and Sports Lesson Teaching Programs in Turkey have been designed on two main teaching fields including "Movement Competence" and "Active and Healthy Life" by considering developmental needs and educational priorities of the students; and it was aimed to make them gain physical literacy behaviors by attending physical activities and sports that are suitable for their development (Ministry of National Education [MoNE], 2018).Although academic physical education programs have been structured to improve physical literacy (SHAPE America, 2013; MoNE, 2018) and several systematic reviews have reported the benefits of physical activity on children (5-17 years old) (Esteban-Cornejo, Tejero-Gonzalez, Sallis, & Veiga, 2015; Janssen & LeBlanc, 2010),it is estimated that 80% of the children (11-17 years old) all over the world can not achieve the goal of daily 60-minute moderate level of physical activity recommended by WHO (2020) (Hallal et al., 2012; Sallis et al., 2016).These rates have been found to be 70-79.9% among the males and 80-89.9% among the females in Turkey (Hallal et al., 2012).

It has been recommended that children have to be busy with moderate level PA during 50% of the current class time in physical education lessons in order to contribute to their PA goals in general (Malina, 1996). However, many students can not fulfill these suggestions also in physical education lessons (Coviello & Dyson, 2005). PA levels of many children and adolescents are not sufficient to get benefit from the positive aspects of PA (Hardy, King, Espinel, Cosgrove, & Bauman, 2010; Sallis, 2000); but, a systematic review has claimed that teaching programs designed to increase the duration of moderate level physical activity among the students can increase this time by 24% compared to the students undergoing normal practice (Lonsdale et al., 2013). A research including many studies (49 countries) has emphasized that effective practices are required in the families, communities and schools in order to promote PA opportunities; and strategic public investments are needed for this (Aubert et al., 2018). Malina (2007) pointed out that inactive children are likely to be the same regarding their inactivity in their adulthood. Inactivity among individuals has the potential to cause negative consequences for the society as a whole. In this respect, physical education lessons have a great importance to make children acquire PA behavior habits and to sustain an active lifestyle in their adulthood (Cox, Schofield, & Kolt, 2010).

Increasing time spent in PA during physical education lessons is associated with their academic learning time (ALT). Effective teaching of physical education is described as a process where majority of total lesson time is spent by active students and ALT (Hughes & Barney, 2009). ALT, that is accepted as the connection between teaching and learning, gives clues to the educators about the quality of education as a time unit resulting with high achievement and low error rates where students participate in activities and teaching materials that can be learnt at the appropriate difficulty level during this process (Rink, 2002). Academic learning time in physical education (ALT-PE) has been investigated by many researchers since it enables to evaluate the quality of education and time to engage in physical activity (Ashy, Lee, & Landin, 1988; Beckett, 1989; Derri, Emmanouilidou, Vassiliadou, Tzetzis, & Kioumourtzoglou, 2008; Dixon, 1997; Godbout, Brunelle, & Tousignant, 1983; Metzler, 1983; Silverman, 1985; Silverman, Devillier, & Ramirez, 1991). In these studies, evidence was found regarding time to engage in motor activity is generally a requirement for learning. Also, it has been reported in two studies

that correct number of trials is associated with achievement (Ashy et al., 1988; Derri et al., 2008). Some studies have focused on the relationship between teaching experience and ALT. While no significant difference was found between ALT provided by the teachers with different professional experiences in some of these studies (Van der Mars, Darst, Vogler, & Cusimano, 1991; Yıldırım, İnce, Kirazcı, & Çiçek, 2007), experienced teacher candidates were found to provide more ALT in some others (Mirzeoğlu, Munusturlar, & Çelen, 2014).Other studies found that Sports, Play and Active Recreation for Children (SPARK) and Physical Activity Cards (PAC) programs, which were prepared to increase PA, affected ALT in a positive way (Esen & Mirzeoğlu, 2016; Fu, Burns, Yang, Brusseau, & Hannon, 2017). Moreover, it was found in a study that an education program prepared for candidate teachers affected ALT positively (Randall & Imwold, 1989). Furthermore, the effects of various teaching methods on ALT were investigated in the other studies. In one of them, ALT was found to be realized most in the lessons taught by exercise, pair work and command methods, respectively (Munusturlar, Mirzeoğlu, & Mirzeoğlu, 2014). Also in another study, PA levels and ALT of the students, who attended physical education lessons taught with tactical game model, were found to be higher compared to direct teaching model (Rodriguez-Negro & Yanci, 2019).

In the light of previous research, it is obvious that ALT is a predictor of the quality of teaching. The above-mentioned studies have shown that ALT is important to enable motor learning in physical education lessons and it may be influenced by the factors such as teacher's experience, teaching model used in the lesson, special programs to increase physical activity and difficulty level of the learning task. Although the research regarding ALT have introduced some findings about the quality of teaching physical education (Beckett, 1989; Derri et al., 2008; Dixon, 1997; Esen & Mirzeoğlu, 2016; Fu et al., 2017; Munusturlar et al., 2014; Silverman et al., 1991), it is still unclear how much ALT is provided by physical education lessons conducted by distance education. However, the relevant literature has shown that students in 31 different states of the USA have been allowed to fulfill their physical education credits through online classes for ten years (Goad et al., 2021); and there was also online physical education before the occurrence of Covid-19 epidemic (Killian, Kinder, & Woods, 2019). A recent systematic review has shown that these practices are used for meeting the needs concerning physical activity (Killian et al., 2019). Moreover, some studies have focused on the quality of teaching in distance education; they have provided evidence regarding the fulfillment of American National Physical Education Standards (SHAPE Standards) and reported that online physical education has the potential to be high quality (Harris & Metzler, 2018; Mosier & Lynn, 2012). However, although the results of the studies have indicated that online physical education practices have the potential to provide quality physical education, a previous study reported that the lack of evidence regarding physical activity and skill improvement is a big gap in the literature (Killian et al., 2019). In this context, there is a need for using different practices to meet students' physical activity needs. The determination of students' ALT in online physical education teaching may contribute to the literature about students' physical activity. The nature of personalized system of instruction (PSI) enabling students to progress in their own speed (Metzler, 2017), its suitability for improving physical fitness (Pritchard, Penix, Colquitt, & McCollum, 2012) and several findings in the literature supporting the improvement of students' performances at their own speed and in a convenient time (Lee & Poto, 1988; Rink, 1996; Silverman et al., 1991; Esen & Mirzeoğlu, 2019) have pointed out that PSI in distance education may be effective in enhancing physical activity behaviors. In this respect, the aim of this study was to examine the effect of physical fitness unit structured with PSI in online secondary school physical education lessons on ALT. The answers to the following research problems were sought to achieve this purpose:

1. Are there significant differences between the students taught with personalized system of instruction and direct instruction (DI) in terms of general content subcategories under context level domain (transition, management, breaks, warm-up, cooling)?
2. Are there significant differences between the students taught with PSI and DI in terms of subject matter knowledge subcategories under context level domain (technique, strategy, rules, social behavior, background)?
3. Are there significant differences between the students taught with PSI and DI in terms of subject matter motor content subcategories under context level domain (skill practice, scrimmage, game, fitness)?
4. Are there significant differences between the students taught with PSI andDI in terms of not motor engaged subcategories under learner involvement level domain (interim, waiting, off-task, on-task, cognitive)?
5. Are there significant differences between the students taught with PSI and DI in terms of motor engaged subcategories under learner involvement level domain (motor appropriate, motor inappropriate, supporting)?
6. Is there a significant difference between the students taught with PSI and DI in terms of academic learning time?

Method

The study model was nonequivalent groups design among quasi-experimental study designs.

Research Group

The study was carried out with 6th graders of a secondary school located in the central district of Bolu province during the second term of 2020-2021 academic year. In this study, students were introduced a learning content for improving their physical fitness elements and their attendance to physical activities was aimed through distance education. The study was designed on 6th graders since physical education teacher, who conducted the study was one of the researchers, and was teaching 6th graders during the study. There was an obligation to conduct physical education lessons online at secondary schools due to Covid-19 epidemic and the highest attendance to physical education was provided by 6th graders at the school where study would be conducted.

Experiment and control groups in the study were determined by unbiased assignment method among the 6th grade students. In the experiment group, lessons were taught online with personalized system of instruction; and the lessons in the control group were taught online with direct instruction simultaneously. There were 15 students in the experiment group (7 females, 8 males) and 16 students (8 females, 8 males) in the control group. Mean age of the students was found to be11.80±.41 years old in the experiment group and 11.85±.40 years old in the control group. However, data on ALT-PE were retrieved from 12 students in the experiment group and 12 students in the control group. The necessary permissions to conduct the study were obtained from Bolu Provincial Directorate of National Education and Ethics Committee at the beginning of the research (E-26428519-044-7573).

Data Collection Instrument

Data of the study were obtained by using structured field work observation technique (Hovardaoğlu, 2000). For this method, online physical education lessons taught simultaneously in the experiment and control groups were recorded on video, and they were assessed by coding with "Academic Learning Time in Physical Education (ALT-PE) Systematic Observation Tool" which was developed by Parker (1989). ALT-PE Observation Tool provides information about what students perform during physical education lesson and how much of the lesson they engage in appropriate physical activity. ALT-PE is composed of two basic domains (context level and learner involvement level), several categories constituting these domains (general content, subject matter knowledge, subject matter motor content, not motor engaged and and motor engaged) and subcategories. The main domains, categories and subcategories of ALT-PE Observation Tool were shown in Table 1.

Table 1. The Basic Domains, Categories and Subcategories of Academic Learning Time in Physical Education (Parker, 1989)

Academic Learning Time in Physical Education				
Context Level			**Learner Involvement Level**	
General content	**Subject Matter Knowledge**	**Subject Matter Motor Content**	**Not Motor Engaged**	**Motor Engaged**
Transition	Technique	Skill Practice	Interim	Motor Appropriate
Management	Strategy	Scrimmage	Waiting	Motor Inappropriate
Breaks	Rules	Game	Off-Task	Supporting
Warm-up	Social behavior	Fitness	On-Task	
	Background		Cognitive	

The basic domain of context level consists of three categories including general content, subject matter knowledge and subject matter motor content. General content involves time not related to the engagement of students in physical education activities. Under this category, time allocated by the students for teaching-related administrative and organizational activities is assessed in the transition; time allocated for class management activities that are not related to teaching is assessed in management; time allocated for discussing a topic unrelated to the subject of the lesson and/or for resting is assessed in breaks and time allocated for warming is assessed in the warm-up subcategories.

Subject matter knowledge involves the information regarding the content of physical education lesson and relevant times. Under this category, technique assesses time devoted to knowledge involving the form of a skill; strategy assesses the time devoted to information about planning how to do an action individually or as a group; rules subcategory assesses time devoted to the explanation of the rules of activities related to the subject; social behavior subcategory assesses the time devoted to provide information about the appropriate or in appropriate behaviors within the activity and background assesses the time devoted to convey information regarding history, notable athletes, habits and records. Subject matter motor content involves the time for physical engagement. Under this category, skill practice subcategory includes time devoted to skill steps and practices; scrimmage subcategory includes time devoted to feedback in the environment while a skill is performed; game includes time devoted to skill practices within a game without the intervention of the teacher and fitness subcategory includes the time devoted to the activities for improving physical fitness elements.

Learner involvement level is composed of two categories including not motor engaged and motor engaged behaviors. Not motor engaged category involves any student engagement behaviors outside the targeted motor activities. This category has four subcategories which are interim, waiting, off-task, on-task and cognitive. Interim subcategory includes the student's interest in something else that is not related to teaching; waiting subcategory includes student's waiting time to repeat the movement; off-task includes the exhibition of an activity or behavior by the student different than the others; on-task includes behaviors related to the subject but do not involve motor activity and cognitive subcategory includes cognitive behaviors of the student concerning the subject.

Motor engaged category includes motor engagement behaviors related to the subject regarding the learning outcomes of the lesson. This category has three subcategories which are motor appropriate, motor inappropriate and supporting. Motor appropriate subcategory involves the participation of student in purposeful motor activity at high accuracy; motor inappropriate subcategory involves in appropriate motor activities of the student (spending time in a way that is not suitable for personal development in a very difficult or easy learning task); and supporting subcategory includes student's help to his/her friends in an activity that takes place in the content of subject matter motor content (Parker, 1989).

Data Processing

A twelve second interval observation/record technique including observation of the first six seconds and recording of the next six seconds was used to process the data retrieved from video recordings (Parker, 1989). An audio tape was used which was prepared previously to determine six second intervals and contained consecutive commands as "observe" and "record" every six seconds. Video recordings that were taken from both experiment (4 lessons) and control groups (4 lessons) were evaluated separately during the study. For data analysis, three students with different motor skill levels (high, moderate and low) were first identified based on the observation of the teacher. Then, the actual activity of each students was coded by the physical education teacher, who was one of the researchers, through six second observe and six second record method; and frequencies were obtained for each category-subcategory (Parker, 1989). If no relevant behavior was observed in any category-subcategory, a frequency was not recorded. Firstly, students with three different motor skill levels were identified to determine ALT-PE depending on the literature (Parker, 1989). Later on, frequencies obtained for each category and subcategory were multiplied with 6; and the times (seconds) of total categories and subcategories were calculated for each student. Then, mean times of the categories and subcategories at each lesson were calculated by taking the average times spent by these three students (high, moderate and low) at all categories and subcategories. Finally, attained times were divided to total lesson time, and percentages of categories and subcategories were determined for each lesson. More than one method can be used to assess ALT-PE data. However, the most fundamental and easiest assessment is made over the percentages of total observation data (Parker, 1989).

Observer Consistency

All lessons observed in the study were recorded by the same observer, and all assessments were made by the same researcher. Van der Mars (1989) has stated that there are two types of observer agreement procedures as intra-observer and inter-observer. In this study, inter-observational agreement procedure was followed since relevant observations and assessments were carried out by a single researcher. The analyses of the observations belonging to 24 students (12 from experiment group and 12 from control group) who were selected from 8 lessons of 80 minute per each (4 in the experiment group, 4 in the control group) were also carried out by the same researcher. In order to ensure consistency of the observations, the same researcher assessed 2 lessons which were selected from each group by random method (1st week in experiment group and 4th week in control group) at 8 weeks following the first assessment. Observer consistency was determined by using the formula suggested by Miles and Huberman (1994). At the end of the calculations made, observer consistency rates obtained in the experiment and control groups were given in the table below.

Table 2. Observer reliability ratios of the context level and learner involvement level domains in the experiment and control groups

Basic domains	Experiment group (1st lesson)	Control group (4th lesson)	Total
Context level	381/(381+18) x100=%95.4	383/(383+9)x100=%98	764/(764+27)x100=%96.6
Learner involvement level	337/(337+18)x100=%94.9	364/(364+18)x100=%95	701/(701+36)x100=%95.11

Observer consistency was found to be 96.6% for context level and 95.11% for learner involvement level at the end of the calculations. A reliability value above 70% showed that observer consistency was at an adequate level (Table 2).

The Procedural Process

Before starting to the study, the management of the school where the study would be conducted and the parents of the students who would be recorded through online physical education lessons were asked for necessary permissions and they were made to sign consent forms. The procedural process of the study was explained in detail below.

Experiment Group: The program and the workbook, which were prepared based on personalized system of instruction that would be used for distance education in the experiment group, were developed by the researchers. Workbook was developed in line with the suggestions of three faculty members. While a faculty member working in the field of movement and training sciences made comments and assessments about the exercises regarding flexibility, strength, balance and endurance included in the learning content (such as the number of repetitions and order of activities, etc.), two faculty members who were specialized in sports education introduced their opinions and assessments regarding the implementation of the models (such as preparation and presentation of learning tasks in the workbook, structuring the setup of teaching model, etc.). These faculty members, who stated their opinions about the workbook and plans prepared, had huge amount of scientific studies on the subjects indicated. The final version of the workbook was created at the end of the process. Each of the students included in the experiment group was given a workbook at the beginning of the study.

The first part of the workbook included information about the content of the book. In this part, information that should be known in the implementation phase of the lesson such as the tasks and responsibilities of the students, what they should do when they need help, the tasks of the teacher, the rules of the lesson and the information about the equipment needed. The workbook was constituted by 50 learning tasks for the students to fulfill several of them. The learning tasks (exercises) in the workbook were generated as including flexibility, strength, balance and endurance abilities which are health-related fitness elements. The book included 14 exercises for flexibility, 14 exercises for balance, 11 exercises for strength and 10 exercises for endurance. The students were allowed to progress by completing learning tasks presented in the workbook one by one. While some learning tasks required self-evaluation, some of them required fulfilling a number of criteria and some needed teacher's consent. What would be done in each learning task was presented in the workbook as written and visual. Moreover, exercises in the learning tasks were supported by video and sent to the students via Whatsapp. Students were enabled to progress in the learning tasks at their own speed since each student had an individual speed and learning capacity. A progress graph was presented at the end of workbook in order to determine at which learning task students were stopped and to help teacher for the next lesson. Students were made to mark the learning task they stopped on this graph and to send it to teacher (for instance; a student might stop in the 8th learning task whereas another might in the 10th task. Each student started from the task that he/she stopped in the previous lesson. Thus, teacher knew which student would start from which task in the following week). The students in the experiment group were enabled to perform the activities in the workbook at their own speed in each lesson; and they were asked to mark up the relevant fields after completing the exercises. The students in this group participated in online simultaneous physical education lessons which were structured with PSI for 4 weeks (40+40 minutes) and the lessons were recorded in Zoom platform.

Control Group: The same unit, same subjects and same activities were carried out online simultaneously with the students included in the control group with physical education and sports teacher through instruction, question-answer, demonstration and command styles. The students in the control group performed the physical activities with the teacher during two lessons of 40 minutes each (a total of 80 minutes) once a week for 4 weeks, and the lessons were recorded on the Zoom platform during the practice.

The lessons in the experiment and control groups were taught by the same teacher who was one of the researchers. This teacher had a 9-year professional experience in PE teaching, had a master degree in the field of sports education and was about to finish doctoral education in the same field. Besides, the teacher has scientific and field studies experience related to teaching models (PSI and DI)

and ALT (Esen & Mirzeoğlu, 2016, 2019). While the teacher taught lessons based on personalized system of instruction in the experiment group, control group was taught lessons based on direct instruction.

Data Analysis

Skewness and kurtosis values were examined for the categories constituting two main domains in order to determine whether observational outcomes from the video recordings of 8 lessons in the experiment and control groups showed a normal distribution or not; and the results were given in Table 3.

Table 3. Skewness and kurtosis values of the subcategories constituting ALT-PE

Basic Domain	Subcategories	n	Minimum Score	Maximum Score	$\bar{X}$	Sd	Skewness	Kurtosis
Context Level	General Content	8	46.80	61.40	53.51	5.61	.141	-1.708
	Subject Matter Knowledge	8	7.50	14.75	12.73	2.65	-1.301	.804
	Subject Matter Motor Content	8	27.38	42.38	33.78	5.07	.422	-.494
Learner Involvement Level	Not Motor Engaged	8	45.04	64.42	55.68	8.37	-.170	-2.157
	Motor Engaged	8	35.59	54.95	44.33	8.37	.168	-2.159
	ALT	8	21.46	43.99	32.96	9.88	.053	-2.479

Skewness and kurtosis values of the main domains were checked whether to control if data in Table 3 showed a normal distribution or not; and they were determined to get values between -2.5 and +2.5. As there are some sources advocating that skewness and kurtosis values should be between -1.5 and +1.5 for normal distribution (Tabachnick & Fidell, 2013), some others have accepted that these values should be between -3 and +3 (Albayrak, 2009; Kline, 2015). Based on these information, it was decided to perform parametric tests in the study. While arithmetic mean, standard deviation and percentage values were used for descriptive statistics, independent samples t–test was used to detect differences between the groups in terms of categories and subcategories. The statistical significance level was determined as 0.05 in this study.

Results

Table 4. The comparisons of general content category and its subcategories in the lessons taught in experiment and control groups

Context Level Basic Domain	Subcategories	Experiment Group			Control Group					
		n	$\bar{X}$ (%)	Sd	N	$\bar{X}$ (%)	Sd	Df	t	p
General Content	Transition	4	17.96	7.87	4	4.61	1.54	6	3.330	**.016**
	Management	4	4.40	2.02	4	22.08	2.66	6	-10.604	**.000**
	Breaks	4	14.38	3.91	4	21.09	2.06	6	-3.041	**.023**
	Warm-up	4	5.98	.81	4	6.33	1.67	6	-.384	.714
	Cooling	4	6.10	1.07	4	4.11	1.15	6	2.546	**.044**
	Total	4	48.79	2.39	4	58.23	2.87	6	-5.053	**.002**

When Table 4 was examined, the time devoted to general content category in total was observed to be 48.79% in the experiment group and 58.23% in the control group. In the experiment group, time devoted to each subcategory was found as 17.96% for transition, 4.40% for management, 14.38% for breaks, 5.98% for warm-up and 6.10% for cooling. For the control group, the times allocated were identified as 4.61% for transition, 22.08% for management, 21.09 % for breaks, 6.33% for warm-up and 4.11% for cooling. At the end of the comparison of time percentages obtained in the experiment and control groups, a statistically significant difference was found between total general content times ($t_{(6)}$=-

5.053, p=.002). When the general content subcategories were compared between both groups, transition ($t_{(6)}$=3.330, p=.016), management ($t_{(6)}$=-10.604, p=.000), breaks ($t_{(6)}$=-3.041, p=.023) and cooling ($t_{(6)}$=2.546, p=.044) were determined to be significantly different.

Table 5. The comparisons of subject matter knowledge and its subcategories in the lessons taught in experiment and control groups

Context Level Basic Domain	Subcategories	Experiment Group			Control Group					
		N	$\bar{X}$ (%)	Sd	N	$\bar{X}$ (%)	Sd	Df	t	p
Subject Matter Knowledge	Technique	4	7.40	4.15	4	8.18	2.78	6	-.315	.763
	Strategy	4	1.51	1.57	4	.65	.73	6	.999	.356
	Rules	4	4.68	3.90	4	3.04	1.46	6	.789	.460
	Social Behavior	4	---	---	4	---	---	6	---	**---**
	Background	4	---	---	4	---	---	6	---	**---**
	Total	4	13.59	1.91	4	11.87	3.28	6	.905	.400

When Table 5 was examined, the total time devoted to subject matter knowledge category was observed to be 13.59% in the experiment group and 11.87% in the control group. According to Table 5, time devoted to each subcategory was found as 7.40% for technique, 1.51% for strategy, and 4.68% for rules in the experiment group. These ratios were found as 8.18% for technique, 0.65% for strategy and 3.04% for rules subcategories in the control group. In both groups, no time was devoted to social behavior and background. Moreover, no statistically significant difference was found between experiment and control groups in terms of subject matter knowledge (p>0.05). The comparisons between both groups in terms of the percentages of subcategories showed no statistically significant differences (p>0.05).

Tablo 6. The comparisons of subject matter motor content and its subcategories in the lessons taught in experiment and control groups

Context Level Basic Domain	Subcategories	Experiment Group			Control Group					
		N	$\bar{X}$ (%)	Sd	N	$\bar{X}$ (%)	Sd	Df	t	p
Subject Matter Motor Content	Skill practice	4	---	---	4	---	---	6	---	**---**
	Scrimmage	4	1.89	1.09	4	2.00	.83	6	-.168	.872
	Game	4	---	---	4	---	---	6	---	**---**
	Fitness	4	35.71	4.25	4	27.96	2.17	6	3.248	**.018**
	Total	4	37.60	3.79	4	29.97	2.61	6	3.314	**.016**

When Table 6 was examined, the total time devoted to subject matter motor category was observed to be 37.60% in the experiment group and 29.97% in the control group. According to Table 6, time devoted to the subcategories was found as 1.89% for scrimmage and 35.71% for fitness. These ratios were found as 2.00% for scrimmage and 27.96% for fitness subcategories in the control group. In both groups, no time was found to be devoted to skill practice and game. At the end of the comparisons of the percentages obtained in experiment and control groups, a statistically significant difference was found between the groups in terms of subject matter motor content ($t_{(6)}$=3.314, p=.016). Also, the comparisons of time percents devoted to the subcategories of subject matter motor content in the experiment and control groups determined a statistically significant difference only in terms of fitness subcategory ($t_{(6)}$=3.248, p=.018).

Table 7. The comparisons of not motor engaged category and its subcategories in the lessons taught in experiment and control groups

Learner Involvement Level Basic Domain	Subcategories	Experiment Group			Control Group					
		N	$\bar{X}$ (%)	Sd	n	$\bar{X}$ (%)	Sd	Df	T	p
Not Motor Engaged	Interim	4	3.09	1.97	4	6.43	3.91	6	-1.523	.179
	Waiting	4	8.16	2.40	4	20.74	2.94	6	-6.633	**.001**
	Off-task	4	2.99	1.49	4	10.66	3.72	6	-3.820	**.009**
	On-task	4	19.37	5.62	4	23.09	5.21	6	-.969	.370
	Cognitive	4	14.74	3.77	4	2.09	.73	6	6.591	**.001**
	Total	4	48.35	3.84	4	63.00	2.37	6	-6.486	**.001**

When Table 7 was examined, the time devoted to not motor engaged category in total was observed to be 48.35% in the experiment group and 63% in the control group. It was seen that not motor engaged category constituted 48.35% of the lesson in the experiment group and 63.00% of the lesson in the control group. In the experiment group, time devoted to the subcategories was found to be 3.09% for interim, 8.16% for waiting, 2.99% for off-task, 19.37% for on-task and 14.74% for cognitive. These ratios were found as 6.43% for interim, 20.74% for waiting, 10.66% for off-task, 23.09% for on-task and 2.09% for cognitive in the control group. When both groups were evaluated for not motor engaged category in total, significant differences were observed in favor of experiment group ($t_{(6)}$=-6.486, p=.001). In terms of subcategories, statistically significant differences were found in favor of the experiment group in the subcategories of waiting ($t_{(6)}$=-6.633, p=.001), off-task ($t_{(6)}$=-3.820, p=.009) and cognitive behaviors ($t_{(6)}$=6.591, p=.001).

Table 8. The comparisons of motor engaged category and its subcategories in the lessons taught in experiment and control groups

Learner Involvement Level Basic Domain	Subcategories	Experiment Group			Control Group					
		N	$\bar{X}$ (%)	Sd	n	$\bar{X}$ (%)	Sd	Df	T	p
Motor Engaged	Motor appropriate	4	41.99	2.67	4	24.06	1.93	6	10.883	**.000**
	Motor inappropriate	4	7.67	1.68	4	12.93	1.76	6	-4.314	**.005**
	Supporting	4	1.76	.70	4	---	---	6	5.048	**.002**
	Total	4	51.65	3.83	4	37.00	2.37	6	6.510	**.001**

When Table 8 was examined, time devoted to motor engaged category in total was observed to be 51.65% in the experiment group and 37% in the control group. As seen in the table, motor engaged category constituted 51.65% of the lesson in the experiment group and 37.00% of the lesson in the control group. In the experiment group, time devoted to the subcategories was found to be 41.99% for motor inappropriate, 7.67% for motor inappropriate and 1.76% for supporting. These ratios were found as 24.06% for motor appropriate and 12.93% for motor inappropriate in the control group. When both groups were evaluated for motor engaged category in total, significant differences were observed in favor of the experiment group ($t_{(6)}$=6.510, p=.001). When both groups were compared in terms of subcategories, statistically significant differences were found in favor of the experiment group in the subcategories of motor appropriate ($t_{(6)}$=10.883, p=.000), motor inappropriate ($t_{(6)}$=-4.314, p=.005) and supporting ($t_{(6)}$=5.048, p=.002).

Table 9. The comparison regarding academic learning time through the lessons taught in the experiment and control groups

	Experiment Group			Control Group					
	n	**$\bar{X}$ (%)**	**Sd**	**N**	**$\bar{X}$ (%)**	**Sd**	**Df**	**T**	**p**
Academic Learning Time (ALT)	4	41.99	2.67	4	23.93	1.77	6	11.283	**.000**

The duration allocated to academic learning time in the lesson is constituted by the time devoted to motor appropriate subcategory of motor engaged behaviors. As seen in Table 9, academic learning time contributes to 41.99 % of the lesson in the experiment group where as 23.93% in the control group. At the end of the comparison of these times, a statistically significant difference was found in favor of the experiment group ($t_{(6)}$=11.283, p=.000).

Discussion, Conclusions and Suggestions

The aim of this study was to examine the effect of personalized system of instruction used in the fitness unit of online secondary school physical education and sports lesson on academic learning time. Data regarding academic learning time were obtained by using Academic Learning Time in Physical Education-Systematic Observation Tool. Academic learning time was examined over two basic domains including context level and learner involvement level, the categories under these domains and their subcategories.

In the study, the highest percentage of time was found to be devoted to general content category in the context level domain in both models (experiment: 48.79%, control: 58.23%). In the previous studies, time percentages varying between 34.67 % (minimum) and 51.01% (maximum) were found to be allocated to general content (Derri et al., 2008; Fu et al., 2017; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). Different from the previous studies, a subcategory of cooling was added under the category of general content in this current study. Accordingly, time percentages of general content increased in both models (experiment: 6.10%; control: 4.11%). The results of the study regarding general content were found to be parallel with the literature when evaluated considering cooling subcategory.

When transition subcategory was evaluated, a statistically significant difference was observed in favor of direct instruction. Online course provided an advantage to DI in terms of transition. On the other hand, students were responsible for organizing their learning environment in PSI, and this allowed them to spend more time in the transition subcategory. Similar results were observed in the study by Munusturlar et al. (2014); and they found that students allocated more time to transition in the teaching methods requiring them to follow specific procedures (exercise, pair work). In terms of the time percentages allocated in the management subcategory, a statistically significant difference was found in favor of PSI. In this study, the presentation of the processes regarding management to the students through the workbook in PSI resulted in less time devoted to management compared to DI. Fu et al. (2017) found similar results in their study conducted with SPARK program. In the other previous studies, percentage of time devoted to management was reported to be higher (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). These results were derived from the fact that PSI and SPARK teaching models decrease management-related procedures.

When time percents of the breaks category were examined, a significant difference was found in favor of PSI. Individual progress of each student in PSI has led to lower breaks and resting times compared to DI. Learning process in PSI avoided off-task behaviors that might occur later by preventing extra waiting among the students showing rapid progress in learning tasks or preventing the interventions of moving on to the other learning tasks without resting among the students showing slow progress. However, when the results of this study were compared with the other studies in the literature (Fu et al., 2017; Mirzeoğlu et al., 2014), it was observed that more time periods were allocated to the breaks in both models. Inability to take records due to the reasons such as disconnection of the

student's camera from time to time and disconnection of internet during online lesson was assessed under the breaks subcategory. The high percentage of time found in the breaks might have caused due to these unexpected situations. When warm-up and cooling time percents in the breaks subcategory were compared, no statistically significant difference was found between both models in terms of warm-up subcategory whereas students of PSI model were found to devote more time to cooling at a statistically significant level. Due to the routine practice of warm-up in the learning content of physical education and the students' consciousness about this, it might not have been difficult for the students in both models. However, PSI students might prefer to allocate more time to cooling exercises due to the tiredness occurring at the end of the lesson. While more percentage of time was found to be devoted to warm-up in the literature compared to the present current study (Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007), the results of the research by Fu et al. (2017) supported the findings of the present study. Since the students were kept under control due to online education in this study and it was planned to move on to the learning activities following a rapid warm-up by using a special SPARK program in the study by Fu et al. (2017) were considered to cause less percentage of time devoted to warm-up exercises compared to the other studies.

In the current study, the highest percentage of time was found to be allocated to subject matter knowledge under the basic domain of context level in both models (experiment: 13.59%; control:11.87%). Previous studies have shown that a time percentage varying between 9.48% and 23.4% (min-max) is devoted to subject matter knowledge (Derri et al., 2008; Fu et al., 2017; Mirzeoğlu, et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007).

No statistically significant difference was found between the models in terms of the time percents of technique subcategory. While the way of performing a motor skill was presented in a workbook and learning videos in PSI, it was presented by the teacher in DI. Therefore, it can be stated that the time spent by the students individually with the workbook and learning videos in PSI is similar to the percentage of time regarding teacher's presentation on how to perform the skill in DI. In this case, teachers may spend their time with the other learning-teaching processes in PSI since they do not deal with presenting how to perform the skills. Previous studies have shown that teachers may give more feedback to the students since teachers do not spend time with the presentations including skill presentation and other information during learning processes structured with PSI (Metzler, Eddleman, Treanor, & Cregger, 1989). While there are studies reporting less percentage of time allocated to technique subcategory (Derri et al., 2008; Fu et al., 2017; Mirzeoğlu et al.,2014), there are also those showing similar time percents in the literature (Munusturlar et al., 2014). In the study by Yıldırım et al. (2007), a higher percentage of time was found to be devoted to technique subcategory.

No statistically significant difference was found between the models in terms of rules subcategory. Although it was aimed to devote less time to the activity rules by presenting them to the students through workbook and learning videos in PSI, the results of the study showed that time devoted to the rules was at a comparable level. Since the students in the control group had an PSI practice for the first time and they participated in these practices through online live lessons with which they were unfamiliar, teacher had to remind activity rules during the lessons from time to time. This situation might be the reason of similar percentage of time devoted to rules subcategory in both groups. Some studies in the literature have reported less percentage of time allocated to the rules compared to the current study (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007), only one study reported a similar percentage of time (Fu et al., 2017).

Similarly, no statistically significant difference was found between the models in terms of strategy. Some of the previous studies have reported higher percentage of time for strategy subcategory (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). However, learning content in this study included movements that would be performed individually and would improve only fitness elements; and this made the students to lack much experience in this subcategory. In addition to this, online coarse of the study resulted in the lack of time devoted to social behavior. On the other hand, no time was allocated to background subcategory since the study did not involve

information about the athletes, up-to-date information and historical information. Of course, such information can be organized in learning contents depending on the content to be taught.

In this study, the second higher percentage of time was found to be devoted to subject matter motor content under context level in both models (experiment: 37.60%; control: 29.97%). In the previous studies, time percents allocated to subject matter motor content was found to vary between 37.03% and 66.71% (Derri et al., 2008; Fu et al., 2017; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007).When subject matter motor content category was examined, the lessons taught with PSI was found to be similar with the studies in the literature whereas percentage of time devoted in the lessons taught with DI was found to be lower than the relevant data in the literature. Teaching the course online and extra time spent by the teacher for management and breaks subcategories are considered to cause allocatingless than desired percentage of time for this category.

When skill practice and game subcategories were examined under this category, no statistically significant differences were found between the models. Besides, it was observed that students did not spend time at these subcategories. In the previous studies, a time percent of various rates was found to be devoted to these two subcategories depending on the learning content (Derri et al., 2008; Fu et al., 2017; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). However, this study covered health-related fitness unit and involved activities for improving the elements under this. Thus, this situation led students not to exhibit behaviors under skill practice and game subcategories. Moreover, no statistically significant difference was found between models when scrimmage subcategory was examined. However, it is expected to devote more time to feedback and improvement due to the structure of PSI model. Such a conclusion might not have obtained since observing student behaviors from the screen during teaching practices through an online platform and providing a feedback-impovement based on this might have been difficult for the teacher. Teachers may enable students to get more feedback-improvement by assigning an assistant teacher role to the students with a high level or to the different instructers if possible during the lesson structured with PSI (Metzler, 2017). However, an assistant teacher was not used in this study in order not to create any confusion due to the facts that the students were aged smaller, they were using PSI for the first time and besides, this model was being integrated into distance education. The results of the study showed that teacher devoted less percentage of time to this subcategory in both models. When these results were compared with the literature, they were found to be similar with the conclusions of Munusturlar et al. (2014); but a higher time percent was found to be reported in the study by Mirzeoğlu et al. (2014). However, the conduction of education by peer teaching model allowed students to get more feedback in the study by Mirzeoğlu et al. (2014).

A statistically significant difference was found in fitness subcategory in favor of PSI in the study. The progress of students at their own speed in PSI prevented the other students, who were progressing more rapidly, to wait for their friends and resulted in a decrease in their sedentary behaviors. Together with this, slowly progressing students prevented sedentary behaviors that might be caused by tiredness by adjusting resting intervals as suitable for themselves. The students were not found to have any experience in the fitness subcategory in some previous studies (Mirzeoğlu et al., 2014; Munusturlar et al., 2014) whereas they were reported to devote less percentage of time to fitness in some others (Derri et al., 2008; Fu et al., 2017; Yıldırım et al., 2007). The current research was planned to improve fitness elements and this might have caused these differences.

In this study, it was also observed that percentage of time allocated to not motor engaged behaviors was 48.35% in PSI and 63.00% in DI. Previous studies have reported a time percent to not motor engaged subcategory varying between 60.10% at minimum and 85.09% at maximum (Derri et al., 2008; Mirzeoğluet al., 2014; Munusturlar et al., 2014; Yıldırım et al.,2007). While the results have shown that not motor engaged behaviors in DI are within the limits indicated by the studies in the current literature, this ratio was found to be quite lower than the literature in PSI. This result can be interpreted as PSI is effective in increasing the percentage of exhibiting motor behaviors among the students. No statistically significant difference was found between both groups in terms of interim subcategory. However, time percents of interim subcategory in both models were found to be higher than the other

studies (Derri et al., 2008; Mirzeoğlu et al., 2014; Yildirim et al., 2007). During the lessons conducted in both models, the cameras of the students were shut down unvoluntarily or voluntarily, the screen was frozen or internet was disconnected; and thus, there were times when recordings could not be made. This situation was accepted as interim period and as situations to be encountered during distance education.

When waiting subcategory was examined, a statistically significant difference was found between models in favor of the experiment group. While the percentage of time devoted to waiting in PSI was found to be lower than the time in some previous studies (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007), time percent allocated to this subcategory in DI was observed to be similar to the relevant findings in some of them (Derri et al., 2008; Munusturlar et al., 2014; Yıldırım et al., 2007). Provision of student progress via workbook and learning task videos enabled them to progress without requiring to wait their friends in the classroom in order to move on to the next learning task; and this led to a decrease in waiting times of the students.

When off-task behaviors were assessed, a statistically significant difference was also found between the models. The results showed that a low level of off-task behaviors were observed in PSI whereas the percentage of off-task behaviors in DI lessons was found to be higher than the literature (Derri et al., 2008; Mirzeoğlu et al., 2014; Yıldırım et al., 2007). While teacher-oriented nature of DI increased the percentage of off-task behaviors among the students, the responsibilities given to the students in PSI decreased their off-task behaviors compared to DI. Together with this, no statistically significant difference was found between models in the subcategory of on-task behaviors. On-task behaviors of the students were resulted from the time when they watched/read learning videos and the workbook in PSI and from the time taken when teacher is presenting learning tasks and class management processes in DI. In the study, both models showed lower percentage of time for on-task behaviors compared to the other studies in the literature (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). Online coarse of the models might have led to devoting less time to this subcategory in this study.

While a statistically significant difference was found between both models in terms of cognitive subcategory, PSI students had a higher percentage of time. A higher time percent was found to be devoted to cognitive subcategory in ITM in the current study whereas percentage of time in DI was found to be lower compared to fimding of the relevant literature (Derri et al., 2008; Mirzeoğlu et al., 2014; Yıldırım et al., 2007). In PSI, students needed to read each task, watch the videos and evaluate themselves in some learning tasks at the same time to progress in learning tasks. These practices in PSI resulted in an increase in the time percents of the students regarding cognitive behaviors.

It was observed in the study that time devoted to motor engaged behaviors was 51.65% in PSI and 37.00% in DI. When previous studies were examined, it was observed that minimum time allocated to motor engaged behaviors was 19.12% and maximum time was 39.89% (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007). While the results have shown that the percentage of motor engaged behaviors in DI was between the limits given in the previous studies, a higher percentage than the current literature was obtained in PSI. The simultaneous use of PSI in distance education in the study increased the percentage of engagement in motor activity among the students.

A statistically significant difference was found between the models in favor of PSI in terms of motor appropriate subcategory. The practice of the students at their own speed in PSI resulted in a higher percentage of motor appropriate activity compared to DI. It was found in the study that the percentage of motor appropriate activity in PSI was higher than the previous studies (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007); but for DI, it was found to be higher than some studies (Derri et al., 2008; Munusturlar et al., 2014; Yıldırım et al., 2007) as well as lower than some others (Mirzeoğlu et al., 2014).The facts that the activities included in both models did not have very difficult movements and that the students participated in the lessons at home and thus, they did

not have distracting elements around have led both models to have higher percentage of time in this subcategory.

When motor inappropriate subcategory was examined, a significant difference was found between PSI and DI. PSI students participated in motor inappropriate activity in a less percentage of time. Due to the nature of PSI, students progress as fast as possible and as slow as needed (Metzler, 2017). In this model, students attended to the activities by using correct and suitable techniques since they progressed based on their individual speed. When motor inappropriate activity percents were compared with literature, this ratio was found to be higher in both groups compared to the other studies (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al., 2007).

A statistically significant difference was found in favor of PSI group in the supporting subcategory under motor engaged category. While no experience was observed in this subcategory in DI, less time was devoted to this subcategory in PSI. Students could not exhibit any supporting behaviors towards their friends in DI where the movements were presented by the teacher and they practiced these movements. However, in PSI, some exercises included in the workbook introduced learning tasks for getting a support from a friend; and such learning tasks helped students to show supporting behaviors towards their friends during motor activity as different than the control group. The results of the previous studies have also supported this finding (Derri et al., 2008; Mirzeoğlu et al., 2014; Munusturlar et al., 2014; Yıldırım et al.,2007).

The results of the study have shown that academic learning time was 41.99% in the lessons taught with PSI and 23.93% in the lessons taught with DI. When both groups were compared, a significant difference was revealed in favor of the experiment group. Although the students participated in a lesson taught with PSI for the first time, the opportunity to practice individually at their own speed with workbooks, supporting their learning tasks with videos and having less number of elements that might distract them in their environment might have led to such a conclusion. Besides, the results have shown that PSI causes a higher academic learning time compared to the other studies (Derri et al., 2008; Mirzeoğlu et al.,2014; Munusturlar et al., 2014; Yıldırım et al.,2007). This conclusion may be interpreted as that PSI can help to stay active during 50% of the physical education lesson as suggested by the literature (Malina, 1996) and thus, daily recommended PA goals of the students may be supported (WHO, 2020).

In conclusion, personalized system of instruction has led to an increase in academic learning time during the implementation of fitness elements at secondary school physical education lessons taught online. In context level, PSI was determined to increase percentage of time devoted to subject matter knowledge. Similarly, model was found to increase the percentage of motor engaged behaviors and decrease the percentage of not motor engaged behaviors in the learner involvement level. Based on this result, it can be suggested that personalized system of instruction may increase correct practice rates of the students in a learning task appropriate to their potential in online physical education lessons. However, in this study, it was determined that students devoted less time to scrimmage subcategory in fitness unit structured with PSI. Giving feedback to each student may be difficult for the teacher in distance education. Therefore, an assistant trainer may be appointed to provide more feedback to the students in scrimmage subcategory at online education.

Together with these, the study has some limitations. One of these limitations is the design of the lessons as covering fitness elements that are suitable for individual studies. Similar studies should also be designed for individual and team sports including skill acquisition. The study was conducted only with 6th graders for four weeks. Therefore, conducting similar studies with students of various grades at secondary and high schools for a longer time will be effective in obtaining more reliable data. Moreover, further research may also use qualitative research designs to investigate the same topic.

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