ACADEMIC STUDIES

IN EDUCATIONAL SCIENCES

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Harun ŞAHİN
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PREFACE

The book “Academic Studies in Educational Sciences” is serving an academic forum for both academics and researchers working in such fields. Educational research is an interdisciplinary by nature. So it covers several fields such as educational sciences and social sciences. In this book, the academics working in different fields share their results with the scientific community. Thus more researchers will be aware of these studies and have some new ideas for their future studies. The selected articles have been reviewed and approved for publication by referees. It is hoped that the book will be of interest and of value to academics and researchers.

Harun ŞAHİN & Nihada DELIBEGOVIĆ DŽANIĆ

REFEREE BOARD

COMPUTER AND INSTRUCTIONAL TECHNOLOGIES EDUCATION

PROPOSING AN INSTRUCTIONAL DESIGN MODEL WITH DESIGNING AND DEVELOPING SENSORY IMMERSIVE VRLE TO TEACH CONCEPTS AND PROCEDURES

Zeynep TAÇGIN*

Introduction

Instructional design (ID) offers a roadmap of theoretical structure to be traced to facilitate instruction (Chen, 2006). ID is also a discipline that needs to apply understanding, development and learning methods in order to achieve the desired change in the knowledge and skills of the learners. ID knowledge structure should increase learning outcomes by organizing cognitive theories that relate to each other and learning, and learning practices (Jen, 2007). When evaluated in this context, according to Hernandez-Serrano, Choi, and Jonassen (2000) after identifying a learning problem that exists in the context of physical reality, appropriate solutions are selected from the possible solutions and design and development are carried out for information integration by using design principles that are appropriate to the technological components.

The main purpose of ID is to increase the learning outcomes with designing effective educational material. So, ID provides more effective and efficient learning (Jen, 2007). As understood, ID is the whole of the systematic methods followed to solve a specific learning problem. From this point of view, it is possible to say that ID differs according to the quality of learning environment and learning objectives. In support of this situation, Jen (2007) stated that ID theories are different from other theories that concentrate on learning and development in the direction of common goals.

As can be understood, ID models need to adapt to the materials that will be produced with developing technology. The specific stages to be followed in the design of the VRLEs (Virtual Reality Learning Environments) that are commonly used to teach in these days, may only be possible through the transfer of other ID models. According to Morrison, Ross, Kemp, and Kalman (2010) in order to adapt other models, existing ID learning theories, information technology, system analysis, educational research, and management are the essential factors.

The selection of the appropriate methodology is necessary to make the ID process, which is a set of multidisciplinary and systematic chains and based on scientific bases. As known, design based approach offers a scientific structure for material development process. From this point of

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view, design based research methodology could be used to develop ID models for the innovative LEs like virtual reality (VR) and augmented reality (AR). We should remind that material development process should be carried out by repetitive, systematic and scientific methods in accordance with Barab (2006); Barab and Squire (2004); Raspopovic, Cvetanovic, and Jankulovic (2016); Wang and Hannafin (2005).

Instructional design in VR environments

ID is the whole set of approaches that systematize all the components that influence the enhancement of instructional outcomes in the created learning environment. Although there are many ID models in terms of learning methods, techniques and strategies, there is not yet a design principle or method developed for VR systems (Mills & Noyes, 1999).

According to Goodwin, Wiltshire, and Fiore (2015), it is difficult to apply traditional instructional strategies and design principles into VRLEs in order to support learning. Application of these strategies and practices to immersive LEs with technological capacity in the dynamic structure poses a problem. This directly affects the realization of effective learning with VRLEs, increasing the dilemma between the instructional interface and the environment.

The design of VRLEs have complex process that requires careful planning and design that complement each other with learning and teaching approaches (Chuah, Chen, & Teh, 2011). When contemporary technologies are addressed, traditional development models such as ADDIE do not have the enough components, nor do they have the repetitive capacity to identify and assist in managing innovative media solutions. This causes designers to identify with inappropriate tools for students and to identify effective experiences (Appelman, 2005). Nevertheless, it is an incredible challenge for educators without technical backgrounds to develop learning applications with VR systems (Hanson & Shelton, 2008).

The fundamental and crucial problem of how to access VR environments is the collision of traditional and constructivist learning approaches in theory (Rose, 1995). From this point of view, it is necessary to develop instructional strategies that will improve the effectiveness and quantities of educational VR applications for support natural skills as far as instructional theories of virtual systems and traditional knowledge structuring applications (Hanson & Shelton, 2008). Cognitive thinking is previously applied to learning and teaching in order to structure the significant experiences that learners are involved as active participants. Most ID uses a variety of activities to provide in-depth processing and reflection (Ramasundaram, Grunwald, Mangeot, Comerford, & Bliss, 2005).

The real question is how VR environments should be used effectively in learning and how they should be designed to increase learning outcomes. For this, instructional designers should determine the appropriate instructional theories and models to be used to acquire individual learning environments (Jen, 2007).

In this section, studies on ID models and examples that can be applied in the development of immersive VR applications have been investigated. In addition, it has been tried to be determined the design principles that required components to obtain an effective learning environment.

VR ID Models

The literature review shows that there are some remarks to design VRLEs. The remarks can be evaluated mainly two categorizes as (1) considers design phases and (2) determines the design components to get reach learning outcomes.

For instance, Goodwin et al. (2015) stated that the important point in the design of VR is to create LE that offers the opportunity to reach optimum learning level with comprehending the right instruments of the human body instead lack of strategy and design principles. From this point of view, they presented a VRLE design approach that based on cognitive science. In this approach, a better way to teach psychomotor knowledge and skills is primarily structured. They have taken a holistic view of the interaction between brain-body and environment and, they present the Strategy of Structured Enactive Engagement in Learning (SEEL). The basic design steps of the proposed strategy are as follows: (1) Analyze / Determine Instructional Context, (2) Analyze / Identify Instructional Resources, (3) Establish / Revise the Learning Environment, (4) Implement/Guide Learning and (5) Analyze/Assess/Revise Learning Outcomes.

As known, when viewed from the design and development window, VR is a conceptualization product produced to reduce the time and cost already existing (Osuagwu, Ihedigbo, & Ndigwe, 2015). Similarly, Hanson and Shelton (2008) presented a design proposal for VRLE design using the processes and principles of design-based research methodology. In that study, the analysis and design phases of ADDIE have regulated for the VRLEs, and the design process and procedures are presented as in Table 1.

Table 1. Basic steps in the design process (Hanson & Shelton, 2008).

Design Process Steps	Definitions
Articulate Expectations	State how the conceived of lesson plan will be enhanced with the utilization of VR technologies. State specifically what it is expected that the user will see, hear and/or feel in the virtual world.
Become Familiar with VR	Research articles and textbooks. Browse the Internet for valuable information. Join List serves. Investigate open sourced VR toolkits and applications. Start networking and making professional contacts. Contact colleagues. Contact leaders in the VR industry and the authors of articles of interest.
Evaluate Design Considerations	Design of the virtual world. Level of desired immersion. Modes of sensory feedback. The degree of user interactivity.
Consider Necessary Resources	Intellectual capacity for VR technologies. Funding resources and amount of funding needed. Write funding proposals.

As can be understood, it is necessary to understand the relationship between learning outcomes and other learning strategies by determining the expectations from VR application for each learning application. This will make it possible for users to understand the interface and to understand the complex design in the virtual environment. At this point, the discovery based VR environment should be supported by enriching the design created by re-evaluating the findings in the direction of limitations and expectations of the project (Hanson & Shelton, 2008).

The other ID model is developed by Chen, Toh, and Fauzy (2004) for VR environments constructed on Mayer's multimedia components and the constructivist paradigm. This model uses Recursive, Reflective Design and Development (R2D2) model. (1) Designing, development, and evaluation of the learning environment is made in the context of repetitive - nonlinear, (2) reflective design and (3) participative design. The four main stages involved in the implementation process are the summative evaluation, packaging, diffusion, and adaptation.

The other type of ID model is based on design components of VRLE that could change with several factors such as hardware, software, target audience, etc. For example, in the study of Chuah et al. (2011), Kansei Engineering methodology has been used to support the expressions, emotions, and feelings with the design parameters. Thus, the user can quantitatively express the relationship between feelings and design parameters. In addition, the Semantic Differential Scale was used, and the pre-determined words (Kansei words) were used by the target user,

experts, and related literature. With this method the ID model was applied that derived from the constructivist perspective of VR based instructional environments developed by Chen, Toh, and Ismail (2005). In the developed learning material, the used design components are (1) coaching, (2) navigational aids, (3) modeling, (4) environment richness, (5) information resources, (6) narration, (7) problem representation, (8) objectives and, (9) multimedia design principles. As a result of the study, it was determined that there is a high degree of relationship between design components and each of the Kansei words or emotional change. The results indicate that VR based learning environment richness is the most effective component. Also, studies show that computer-based instructional materials affect learners positively and this effect increases learning performance. The second most effective design component is coaching. For this reason, the coaching and feedback that will be presented regularly in the learning environment ensure that the users feel comfortable when completing their duties. These design components are directly related to interface aesthetics.

The results of another research show that complex cognitive applications of learners have facilitated thanks to 3D and spatial representation. Also, the model used in designing and developing the LE needs to be selected correctly. In addition, the significant difference between experimental and control groups that do and do not apply VR has been explained by the cognitive extra resources offered in 3D contexts that reduce learners' cognitive effort (Chen, 2006).

Additionally, Dalgarno and Lee (2010) presented a general framework of characteristics that should be considered in the design of VRLEs in order to achieve potential learning outcomes. However, this conceptual framework needs to be tested by empirical studies.

When the studies are evaluated, the model called Experiential Modes-EM presented by Appelman (2005) has more inclusive structure. EM focuses on simple and basic principles of complex and repeated complex models so it can be adopted to several LEs from micro level to macro level just like quantum physics. According to Appelman (2005), the creation of instructional environments focuses on what educators are going to do, but the new immersive VR environments challenge the instructional designers with their increasingly experimental features. The method developed from this point focuses on the fundamental variables that designers can follow to make a student-centered correct design for every kind of learning environment. No systematic model was found in the literature to guide the design of various VR environments such as EM. EM presents a methodology for filling the void in order to design and enhance the EM via (1) defining and (2) designing dynamic learning environments.

Once EM is structured with all desired perceptions and features, appropriate technology, methodology and physical environment need to be selected for the targeted EM (Appelman, 2005). The characteristics of the LEs and learning perceptions to be formed in this context are presented in Table 2.

Table 2. Components of EM (revised from Appelman, 2005)

	Learning environment attributes		Learners perceptions within the environment		
Features controlled by the designer	Virtuality	The degree of representation of persons, places, or things	Interaction	Communication or contact with a person or thing	***Physical environment related***
	Physical structures & background	Infrastructures: hidden affordances or capabilities Superstructures: real or virtual definitions of space Background: smells, sound, & light	Sensory immersion	Engagement through visual, auditory, haptic, kinesthetic, & olfactory senses	
	Spatial boundaries	Real or virtual limitations of access or motion	Mobility	Freedom of motion to another place	
	Time boundaries	Limits of time imposed on activities	Apperception of time	Apperception of the flow of time	***Related to perceived and applied technology and methodologies***
	Individuals, objects, and events	Interaction with an existing person, environment, or object	Access to information	Options available for gathering information	
	Technologic features	Tools and processes available to use	User control / manipulation	The functionality and the features of the technologies	
	Density of context	The context of regular content from the initial level of learning	Perception of contents	Awareness of the scope of content	***Related to thought the idea of content***
	Tangibility	Lack of embodying concepts	Cognitive change	Understanding and perceiving new procedures, concepts, and principles	
	Reality	The degree of probability with a real person, area, object or process	Emotional changes	Building new attitudes and values of people, scope, space or objects	

LEs should be structured appropriately for the purpose of particular epistemology and ID. In order to use this model effectively, it is necessary to identify global features and perceptions that exist at the macro level for the learning environment. At this stage, it may take hours, days or even weeks to divide or consolidate different decisions in the LE.

In order to define the particular components of meta-structured of the LEs, it is necessary to evaluate the ID strategies and epistemological aspects, identifying the perception and features at the macro level, designing the given LE. In short, EM focuses on the perceptions of learners in order to fill the gap between ID and learning components by making a micro-analysis (Appelman, 2005).

ID components of VRLEs

In the VRLEs, the theoretical models of interaction are divided into three categories as (1) task-application model, (2) explorer discovery model and (3) aggressive system model (Mills & Noyes, 1999). When VRLEs are evaluated in the scope of this study, 3D simulations and games contribute to the rich participation of learners and, teaching and learning by discovering with structural and metaphorical representations, structuring and manipulating the virtual object (Dalgarno & Lee, 2010). Appropriate models should be used in the design and development of VRLEs in this paradigm. This process should be based on redefinition and revision (Chen, 2006). The studies for developing the task-application model of environments related to VR based systems show that the user should be able to discover the virtual environment by defining the interaction with the system (Mills & Noyes, 1999).

The discovery of the virtual environment depends on the navigation system in itself. For this reason, while the VR environment is being created, the navigation problem must be overcome and the student must be directed throughout the learning process. Thus, it is possible to reduce the cognitive load on external factors (Chen et al., 2005). The results show that the positive feelings contained in most impressive design components are related to the enrichment and orientation of the environment. Ultimately, unsecured connections and emotional sounds can be used to inform in the future of computer-based VR environment design (Chuah et al., 2011).

As will be apparent from the foregoing, the components of the constructivist paradigm based immersive VRLEs design should be designed and evaluated in a multidimensional manner. When evaluated in this context, it is necessary to use appropriate sub-design models in accordance with the required components. The characteristics of the virtual environment, the supported learning methods and the fundamental

features that should be considered as the immersive environment are presented in Table 3.

Table 3. Instructional design components in VR environments

Features of the environment	Learning method	Key features
Discover	Discovery-based	Interactivity Navigation Instruction and guidance Monitoring Degree of immersion High fidelity Embodiment Recording Instant feedback Repeatability Context Design components Motivators Learning outcomes
Embodiment	Individual	
Experimentation	Experiential	
Questioning	Inquiry-based	
Problem-solving	Problem scenario	

As an example of the compilations study of Ramasundaram et al. (2005) has created trips by using the mechanism of (1) discovery-based learning, (2) analogy-based learning, (3) scientific inquiry learning and (4) concrete-based learning. In those trips, learners can monitoring learning processes in a simulation environment but they cannot experience in the physical environment. Interaction functions applied in the study are animations, focus questions, hyperlinking guidance, exploration of 3D models and adaptation of the selected simulation. The used focus questions are highly effective techniques for directing students to explore animations. Hierarchical structure was used in hyperlinks and it was designed to be able to zoom, rotate and horizontally-vertically orient the 3D models. Students are experiment-based learning by observing their choice in various scenarios according to their preferences. In the study, designers have improved by redefining ongoing repetitive processes, interpretations and virtual models (Ramasundaram et al., 2005).

Such environments need to support individual learning through constructive feedback and assess the process of discovery, problem-solving and implementation. Thus, the effectiveness of VRLEs can be measured.

Purpose

The purpose of this study is to develop a sensory immersive VRLE in accordance with the examined ID principles. The ID models mentioned above were examined and analyzed, also a new road map was identified and monitored in line with the subject and learning outcomes to be taught with the developed simulation.

VRLE has been developed for nursing students to teach various concepts and procedures related to preoperative procedures. The developed simulation has been developed to provide nursing students with basic terminological knowledge who have gone to the surgical internship to reinforce their knowledge and obtain application skills. It is also intended to present an ID model proposal to develop immersive VRLEs in order to teach conceptual and procedural knowledge from the point of design and development phases of this simulation.

PROJECT

In the designing and developing phases of this VR simulation environment, the used basic theories and methods in order to teach particular concepts and procedures, and to provide practical skills about the relevant procedures are as follows:

(1) Polya's heuristic ID model that based on the ADDIE model
(2) Experiential Modes of Appelman (2005)
(3) The model of Chen et al. (2004)
(4) The sample and parameters of Chuah et al. (2011)
(5) The model of Goodwin et al. (2015)
(6) The design proposal of Hanson and Shelton (2008)
(7) The model of Dalgarno & Lee (2010) and
(8) Other relevant instructional design theories.

This study required project management in the material development process because of (1) the existence of experts from different disciplines, (2) the learning scenario design and material development process based on evaluation-revision basis, (3) the development of VRLE in the direction of learning principles and scientific methods, (4) the material development process is long and (5) costly. The fundamental steps of this study in the line of mentioned above are (1) analysis of problems, (2) design and development, (3) evaluation and retrospective and, (4) reflection to produce design principles.

Analysis of problems

Need assessment is a fundamental step in the ID process (Stefaniak, Baaki, Hoard, & Stapleton, 2018). So the aim of this stage is to identify and determine the problems experienced in the teaching of the subject to be taught. Existing limitations in the teaching methods and techniques used in the education of surgical nurses were determined and the necessary data for the education need analysis was obtained by conducting an in-depth literature search on current applications.

The findings show that simple scientific knowledge in educational institutions is provided with guidance in classroom teaching within the curriculum despite the fact that clinical practice skills are acquired

responsibly and independently (Ten Cate, 2007). On the other side, skills laboratories (Herrmann-Werner et al., 2013), scenario-based learning (Herrmann-Werner et al., 2013; Kneebone, 2003; Kneebone et al., 2002; Ota, Loftin, Saito, Lea, & Keller, 1995; Paige et al., 2009; Ramnarayan Paragi Gururaja, Yang, Paige, & Chauvin), web-based reinforcers (Kneebone, 2003; Ramnarayan Paragi Gururaja et al.; Ward, Gordon, Field, & Lehmann, 2001; Whitson, Hoang, Jie, & Maddaus, 2006), simulated environments (Kneebone, 2003; Marohn & Hanly, 2004; Ota et al., 1995; Paige et al., 2009; Ramnarayan Paragi Gururaja et al.; Windsor, 2009) (Alfred & Rice, 1990; Satava, 2001; Undre et al., 2007) and problem-based learning methods (M. Davis, 1999; T. Davis et al., 2010; Jones, Higgs, De Angelis, & Prideaux, 2001; Ramnarayan Paragi Gururaja et al.; Sachdeva, Pellegrini, & Johnson, 2008; Ward et al., 2001; Whitson et al., 2006) are used for the development of practical skills as well as mentoring and traditional observation.

These methods have relevant limitations to teach effectively and it seems that the simulation and the VR are the solutions to overcome the constraints. The basic components that should be considered in the design of the simulations in order to obtain the desired learning outcomes in accordance with the literature can be summarized as high fidelity design, opportunity for repetitive practice, theoretical basic knowledge, constructed instant feedback, self-evaluation, formative evaluation, problem-based learning – learning scenario, debriefing, meeting individual learning needs and supporting various learning strategies, and teamwork.

Design & Development

This section includes the topics, scope and procedures for the development of the recommended simulation environment, the preparation of the storyboard, and the development of the simulation.

Initially, an unstructured interview was conducted with five surgical nurses to obtain information about the procedures and sub-specialties of surgical nurses and the preoperative preparation process. Findings from interviews show that nurses don't get the necessary practical skills during their formal educational life and they don't specialize in specific areas.

P3: I have been a nurse for 6 years. I decided to study the "operating room services" section at the university hospital where I was working at the 5th year of my profession. But when I look at it, I am more informed than classmates because they do not have the opportunity to practice. My professional learning has taken 2 years. I think the training is insufficient in acquiring the necessary experience. This job is learned by living...

P5: I have been a nurse for 8 years and graduated from a 4-year nursing school. When I evaluated the education given in the school, it was not bad

but it was inadequate. The practice possibilities were limited and it took time to get used to this active environment of the operating room. Every surgery in the hospital has a different case and different requirements. Foreseeing these are directly related to the experience. There is a need to increase opportunities for knowledge and practice before nurses begin to enter the operations.

Literature and view of participants suggest that a learning environment is needed to reinforce practical skills. The learning material should be suitable in accordance with the learning curriculum and terminology. For this reason, before creating the instructional scenario of the developed VRLE, the documents and application procedures of Acıbadem Hospital Nursing School (2016), the Ministry of Education (2012) and Vitale Hospital (2016) were examined, and the phases, standards, and points to be considered in the implementation of the preoperative procedures were determined. After that, a basic lesson plan was created and, a learning scenario was established by the instructional designer. In this context, (1) a case diagram was prepared for the general structure of the instructional scenario, (2) all the instruments to be placed in the operation room were identified, (3) the steps of the application procedures were determined, (4) surgical instruments and sets were determined, and (5) Storyboard was created with the images in Twine. In order to obtain the related media, the researcher visited 2 hospitals and obtained totally seven videos as 35 seconds, 7 minutes 40 seconds, 52 seconds, 17 minutes 43 seconds, 1 minute 33 seconds, 17 minutes 43 seconds and 5 minutes 33 seconds long. The gathered videos were combined, categorized and analyzed using the Camtasia Studio 8.0 program. The analyzed videos were added to the relevant parts of the storyboard and transmitted to the programmer team for coding the simulation environment.

Simulation development

Completion of the 3D drawings specified in the storyboard lasted for three months at the first stage. In this process, (1) the operating room was designed and edited, (2) surgical instruments related to gynecological, major and minor sets were designed. The 3D drawings of 108 surgical instruments including 23 in the obstetrical set, 58 in the major set and 27 in the minor set were made. The 3D design of the operating room was revised using some of the drawings in the Unity Assets. Using the obtained 3D drawings, the programming phase was started to synchronously advance in the design phase. Following the completion of the first phase, it was decided to add the urology instrument set based on the recommendation of the subject expert. The 60 instruments in the urology set were integrated into the learning scenario as name, feature, visual and catalog information and delivered to the 3D designers.

Subsequently, the list of surgical instruments in the obstetrical set was updated on the recommendation from the subject specialist and some of the instruments were revised in accordance with the new list. In this direction, 3D drawings of 16 new instruments were designed.

A total of 146 surgical instruments were 3D drawn within the scope specified. The drawing of the container required to place the 3D drawings in the surgical container was performed according to the number and position of the completed instruments. With reference to the instructional scenario prepared for placing 3D objects in the container in accordance with the medical terminology.

When surgical instruments were placed in the container, they were examined one by one and their suitability for high-fidelity was evaluated. In this context, it has been determined that there are various deficiencies in the design of 42 surgical instruments. Then 3D designer and researcher came together and made necessary explanations for the drawing of related tools. The shortcomings of the drawings took 15 days to complete. In this direction, the sizing of the tools, the increase of the sensitivity of the tick marks at the ends, and the editing of the textures of the drawings was provided.

Upon completion of the relevant deficiencies, drawings were transferred to Unity for coding. After this process, the appearance of the drawings due to the texture feature has been affected and the related glitch has been removed by adding texture.

The software development process lasted 30 weeks, except for 3D designs. In this process, the researcher made a total of 13 field visits to the software company. The duration of field visits varies between 10 and 40 hours (1-3 days). In this context, the software development process has been observed and tested continuously by the researcher.

Evaluation and retrospective

Project Team

The project team consists of two 3D designers, a programmer, an instructional designer and two subject experts. Also, convenient sampling is used in qualitative research sampling methods and an unstructured interview was conducted with 5 expert nurses for the education need analyze. Additionally, the developed VR simulation was used by two subject experts and three instructional designers to support the reliability of this study.

Data gathering tools

- *Simulation effectiveness tool:* Simulation Effectiveness Tool was used to measure the effectiveness of the simulated VR in terms of learning

(level of acquiring knowledge and skills) and attitude satisfaction (acceptance as instructional technique) (Cordi, Leighton, Ryan-Wenger, Doyle, & Ravert, 2012). The scale consists of three subcategories: (1) attitude, (2) learning, and (3) confidence and its Cronbach alpha was calculated as .93. The scale consists totally 20 items and each subcategory respectively consisting of 6, 9 and 5 items.

- *Semi-structured:* Criticism, views, and suggestions of instructional designers and subject were gathered to make the simulation effective. It was aimed to determine the participants' likes and dislikes about the VRLE, the deficiencies, the situations where the VRLE is suitable for the profession and the suggestions for obtaining a better VRLE. Voice recording was received during a semi-structured interview.

Data analysis and evaluation

- *Simulation effectiveness tool (SET):* The scale is rated as a five-point Likert (5) strongly agree, (4) agree, (3) undecided, (2) disagree and (1) strongly disagree. The maximum score of a participant from a 20-item scale is 100, and the minimum score is 20. The total correlation of the items ranges from 0,32 to 0,83. The finalized version of designed and developed VR simulation was applied to two subject experts and three instructional designers and then SET was applied to them in order to assess the effectiveness of the VRLE. Cohen's Kappa coefficient was calculated to determine the internal consistency between the evaluations of subject experts. In addition, the Weighted Cohen's Kappa coefficient is used to determine the consistency between the disagreements of the evaluators. Also, Fleiss Kappa internal consistency coefficient was calculated in order to determine the internal consistency between the evaluations of instructional designers.
- *Semi-structured:* The voice recordings were taken during the interviews conducted to determine the criticism, views, and suggestions of each participant about the VLRE were transferred to the computer. The obtained written documents were divided into subcategories and content analysis was applied.

Findings

How is internal consistency between evaluator?

The Fleiss Kappa analysis was performed to calculate the internal consistency coefficient for Simulation Effectiveness Tool between the evaluations of the instructional designers and the Fleiss Kappa coefficient was calculated as 0.885. This suggests that internal consistency between instructional designers is close to perfection.

Cohen's Kappa internal consistency coefficient between the evaluations of subject experts on the Simulation Effectiveness scale was

calculated as 0,239. The subject experts gave the same scores to 13 items (65,00%). However, when Cohen's Kappa coefficient is evaluated within the reference table, the internal consistency can be considered as moderate. The Weighted Cohen's Kappa coefficient calculated as 0.286 to determine the consistency between the disagreements of the evaluators.

The fact that the scale used in this study has a five-point Likert structure seems to reduce the internal consistency. Because the answers given by the participants seem to be distributed between "I agree" and "I strongly agree".

Reflection to produce design principles

The effectiveness of ID can be measured by the degree of providing the required learning outcomes. According to Morrison, Ross, Kemp, and Kalman (2010), the most important point in the ID process is how to transfer the content to achieve required learning outcomes for learners. In this process, the learning strategies should be determined correctly in accordance with the determined learning objectives. "Productive strategies" have to be used in order to keep learners in mind for longer by linking new knowledge and previous knowledge. The types of productive strategies presented by Jonassen (1988) for the realization of meaningful learning are (1) recall, (2) integration, (3) organizing, and (4) detailing.

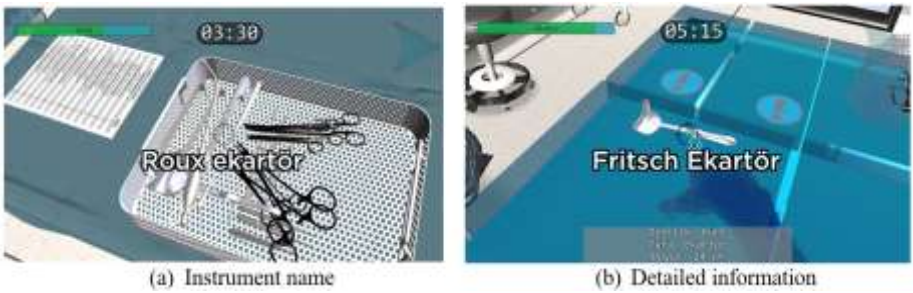
Design components in the direction of instructional strategies

The required learning outcomes of the developed VRLE are included in the prepared lesson plan. When the simulation is intended to be developed and the Keller plan is considered, it is seen that the individuals who use the simulation are aimed to teach (1) concept, (2) principles and rules. The expanded performance content matrix for this study is presented in Table 4.

Table 4. The expanded performance content matrix

Content	**Performance**	
	Remembering	Implementation
Concept	Expression of surgical instrument names	-
	Expression of surgical instrument information	-
	Expression of instruments in surgical sets	-
	Surgical instrument set types	4 different scenarios
Principles and rules	Knowing the processes of laying cover on the Mayo table, opening surgical instrument set and placing surgical instruments on mayo table	Learners apply processes sequentially
	Expressing the types of instruments to be placed in accordance with the areas of the mayo table	Placement of surgical instruments according to the locations of the mayo table

According to Morrison, Ross, Kemp, and Kalman (2010), recall performance is memorizing the content without thinking mechanically. For this reason, the definition of the concept, rules or steps of the process can be listed. In implementation performance, the learned content must be applied to a new situation. In addition, each cell of the expanded performance content matrix points to the used instructional strategy. As can be seen in Table 4, the concepts that are expected to be learned by simulation users are categories in accordance with surgical instrument names, information, and sets. These concepts need to be remembered in order to learn, and the information must be supported with repetitive reminders in order to facilitate remembering.



(a) Instrument name (b) Detailed information

Figure 1. Reminder examples for instrument names and details

As seen in Figure 1 (a), simulation users can see the name of the instrument on the screen when looking at surgical instruments. In order to get detailed information about the instruments, the information of the related instrument is displayed at the bottom of the screen when pointed with the index finger like in Figure 1 (b). This information can be accessed repeatedly for each instrument. An instrument list from the surgical instrument container was used to describe the instruments in the different surgical sets. Users have access to the necessary information about the four different surgical instrument sets and instruments in them. Thus, it is aimed that learners can classify. This feature can be considered as an organizational strategy.

As a principle and rule, it is expected that learners should learn the implementation process and instruments to place in accordance with the areas of the mayo table. In order to teach the implementation process, students have to practice in sequence within the simulation scenario. Thus, users cannot pass to next stage without completing the previous stage. In order to teach how to proceed in the simulation scenario, a usage instruction can be considered as a model. In the teaching of psychomotor skills, it is necessary modeling the task and shows how the task is done. With this, it is possible to teach complex psychomotor skills to novices (Morrison et al., 2010). According to Schunk and Zimmerman (1997) modeling is related to self-regulation, and in the context of social

cognitive theory in order to provide learning, (1) inhibition/disinhibition that individuals executed behaviors as a result of the observation, (2) facilitative response and (3) Bandura and Jeffrey (1973) observing numerical or verbal coding of learners in order to recall knowledge is necessary. Tasks to be performed are presented within the scope of the instruction video and it is always accessible from the menu.

In this way, the required rules are presented in the sample implementation videos before the simulation application. Therefore, it can be said that rule-sample strategy is used through modeling in order to teach procedural processes. Thus, learners can exhibit their performance in simulations by organizing their knowledge.

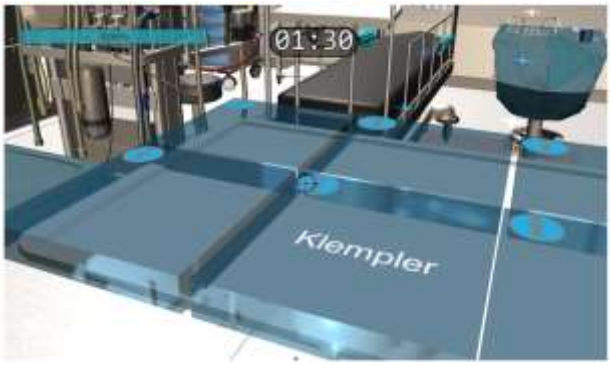


Figure 2. Marker to place instruments on the Mayo table

In order to place the instruments in the correct locations of the Mayo table, areas of the table should be cognitively comprehended, the instruments should be classified in accordance with their type, and it should be placed in the relevant area. For this purpose, as seen in Figure 2, markers were placed on the Mayo table as a reminder. When the user looks at the marker, the instrument type that should be placed on the corresponding area of the table appears and 3 seconds later disappears. With this method, it is aimed that the learners can remember the areas repeatedly. The learners who learned the areas were classified surgical instruments according to the category and placed in the related areas.

On the other hand, the VRLE is an example of a detailing strategy with the high-fidelity design of the operation room and the instruments. In this way, it is aimed that when learners meet the environment and instruments in the real environment, they can easily transfer the obtained knowledge. In addition, learners are expected to integrate their knowledge to different scenarios by allowing procedures repeatedly thanks to the availability of four different surgical instrument sets in the simulation environment.

Figure 3. Application videos as a modeling strategy

Additionally, rule-sample, sample-rule strategies are used to teach methods. There are two fields named "Usage instruction" and "Application videos" on the menu screen in order to access ideal implementation of the examples and applications. As mentioned, example scenarios and steps are presented as audio video to learners within the usage instruction, so that the use of the simulation and the use phases are shown in order. In the application videos section, modeling was used through the sample application videos that consist nine fundamental phases that the learners had to complete the simulation as seen in Figure 3. The videos were recorded in the physical operating room by accompanying the expert nurse.

On the other hand, one of the most important advantages of the developed VRLE is the provided natural user interface interaction. Moreno and Mayer (2007) explain the types of interactions in the multi-model learning environment with the cognitive-affective model in learning with the media. The types of interaction are classified as (1) dialoguing, (2) controlling, (3) manipulating, (4) searching, and (5) navigating. In this study, it is seen that manipulating and navigating are actively used as interaction.

Figure 4. Report screen sample

The other components that are used in simulations for self-learning are the report screen, progress and time indicators, which enable learners to

acquire cognitive and psychomotor skills in the direction of learning objectives and to reinforce the knowledge they possess. The components used for the assessment of the individual learning are (1) report screen as delayed feedback, (2) time indicator, (3) progress indicator and, (4) restricted flow (users cannot interact with other objects without the completion of the previous one) as constant feedback.

Learners need to analyze their own implementation processes by evaluating the correctness of their implementations in order to support individual learning. For this purpose, a report screen is designed for evaluating the performance by returning to the menu screen after the simulation application. The report screen which is programmed in line with the specified implementation steps is logged as "correct" if the desired application is performed and "wrong" if not. In addition, every interaction is recorded as a screenshot during the implementation. Logged visuals and information are presented to learners on the report screen. Thus, learners can review all their applications sequentially. If they make mistakes, they can watch the sample application videos that are added to teach the correct application. Moreover, learners can follow themselves throughout the application process with the optional progress and time indicators in the simulation. Within this scope, the application completion time, success rate, and the number of incorrect and correct applications are presented to the learners on the report screen.

ID model proposal

The developed simulation is designed to teach practical psychomotor skills and basic cognitive knowledge. According to the Romizowski (2016) simulation is the suitable learning technique to teach these and the phases of Polya's heuristic ID model gives roadmap to design simulation structure. From this point of view, the overall design process of this study is structured in the direction of Polya's heuristic ID model.

The interface and definition of VRLEs are changing day by day thanks to the technological possibilities that are developing today. However, the technological components used in the VR environments have been transformed. This situation raises the need to ID for VR environments. Moving from this, various ID models and parameters are presented above for immersive and non-immersive learning environments. However, a generalization of these models and parameters for each VR environment is not appropriate. As a solution to this, the parameters presented by EM of Appelman (2005) could be accepted as a guidance. The parameters included in the EM are suitable for customization in the direction of the targets of the environment to be developed. It is considered possible to customize the design components of the developed virtual environment by optimizing these parameters according to technological possibilities.

However, as noted, design alone is not enough to get reach the learning objectives. At this point, the results of educational need analysis and subject expert evaluations are extremely important. As such, the learning needs of nursing students are becoming more specific as mentioned in the relevant educational need analysis part of this study.

“Realism” has enormous importance to support cognitive processes (Herrington, Reeves, & Oliver, 2007). Hence, nursing students need to be able to practice repeatedly in realistic environments and to be supported with feedbacks to self-assessment during and after this process. It must also be learned from the scenario, and individual learning needs must be met. These factors have been tried to be added to the developed VRLE. On the other hand, teamwork and debriefing are not included in the scope of features that may be added to individual teaching environments. In order to add these components, the simulation needs to be supported by different hardware components. This model can be used to design VRLEs with similar technological capabilities to be developed to teach concepts, principles, and rules.

As can be understood in the light of mentioned above, it can be said that a unique ID model is used within the scope of this developed VRLE when considering hardware components, functions, scenario, target audience, learning needs and content. This model is called as “Sensory immersive VR simulation development model in procedural learning” and its components are presented in Figure 5.

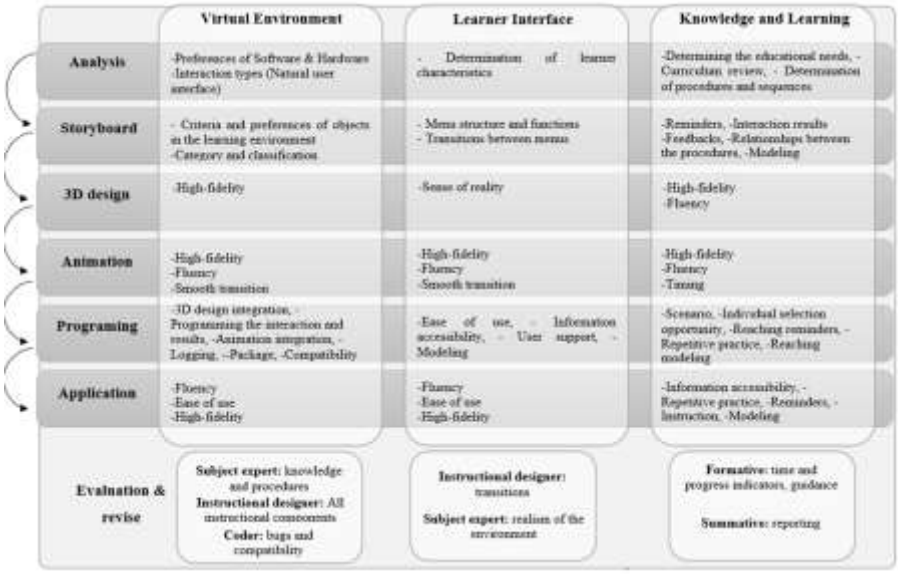


Figure 5. Sensory immersive VR simulation development model in procedural learning

As can be seen in Figure 5, “Sensory immersive VR simulation development model in procedural learning” makes it necessary to manage three basic fields for ID process as (1) virtual environment, (2) learner interface and (3) knowledge and learning. This model has seven basic processes and progress is made sequentially between processes. similarly, with other ID models, all processes include evaluation and revision phases. Evaluation and revision phases are carried out by the project team members who play role in the process in accordance with their own expertise.

Conclusion

The way to design and develop effective instructional materials and environments is through the planned and systematic progress of the ID process. Several ID models exist to manage the process of material design, and some of them provide a general framework for this process. However, applying such models to the material development process as it is may not be sufficient to obtain the desired learning outcomes from the material obtained. This is due to the need a specific approach for the material to be developed and the knowledge, skills and other learning outcomes to be gained.

In this study, it was aimed to teach psychomotor skills related to cognitive information and application procedures for basic concepts in a certain area and to create a repetitive learning environment for reinforcing the learned information. The implementation steps of the approach based on an explanatory instructional strategy is presented by Romiszowski (2016) that proposes cyclical processes to provide both cognitive and psychomotor development of learners and create cognitive schemas for key concepts. As Romiszowski (2016) points out, the approach that is aimed at practical skills between behaviorism and cognitive learning in such settings is Polya's heuristic ID process. Moving from this, the steps of the heuristic ID process presented in the book of Romiszowski (2016) have been referenced from the beginning of this study. Romiszowski (2016) suggests simulations that allow repeated practice as an instructional technique to reinforce psychomotor skills. As a result of these determinations, instructional method, strategy and technique have been determined and ID has been started in accordance with these determined steps.

As is known, the ID process requires different specializations as a multidisciplinary process (Potter, 2016). The strategic planning of the ID process becomes even more important, especially as the educational environment to be developed is an environment that requires innovative and in-depth specializations such as VR simulation. The project is prepared for this study after determining the all necessities (e.g:

equipment, expert) for the simulation and cost analysis was carried out. Within this scope, all expenses, especially the hardware, software and personnel costs to be used, have to be determined. Thus, it was possible to determine the outline of the study.

The lead actors of this study are the instructional designer who is researcher at the same time also, subject expert, 3D designer, and programmer. The researcher made an educational need analysis to design the learning environment, evaluated these processes with the subject expert and prepared the simulation scenario in accordance with the determined needs. In order to support instructional effectiveness (1) curriculum compliance, (2) procedures, (2) visuals, (4) knowledge to be taught, (5) evaluation methods, (6) interface design template, (7) transitions, must be determined and (8) the scenario should be prepared (9) detailed and understandable in the direction of the components. The storyboard, which is the prototype of the software to be developed, needs to be understood by the other members of the team and reflect the main structure of the learning environment. Thus, the appropriateness of the curriculum and instructional components of the storyboard must be assessed by the subject expert, and after it has been finalized, it should provide a roadmap to the development process of 3D design and software development specialists.

3D designs have been made in accordance with the scenario, they have been checked, revised and the software has been developed according to the procedures to be taught. As can be understood, the design and development processes are crucial in order to get reach the finalized version of the software. For this, the continuous communication between the team members, product evaluation, and offering targeted outcomes are necessary. The cyclic structure of the material development process is related to the sustainable development of the product.

Close collaboration between clinical specialists, simulation developers, and medical educators will guide VR simulations that will be designed in the future (Andersen, Mikkelsen, Konge, Cayé-Thomasen, & Sørensen, 2016). On the other hand, many other side players seem to be involved in the elimination of other needs in the product development process. This process requires project management, and data should be gathered by negotiating with different subject experts, and qualitative and quantitative research methodologies should be utilized as supportive.

It is also apparent that the project to design and develop a VR simulation, a long and troublesome process, is costly at the same time. However, as seen at the developed medical VRLE simulation of Cid (2017), the cost should not be considered as a disadvantage. Because the

repetitive learning environment provides a sustainable contribution to the learning of the organization in the long run.

It is necessary to set up the system correctly in order to provide the desired learning outcomes and get reach the effective learning material. As it is known, ID is the whole systematic processes that can be customized for needs. However, there are few articles for novice VR developers (Hanson & Shelton, 2008). It is seen that the developed ID model in line with the processes mentioned in this study is also customized within itself. A model proposal has been offered to develop a VR that supports key concepts for cognitive knowledge and procedural applications for psychomotor skills with using the particular technological equipments, the instructional scenario, the determined learning outcomes and application situations are taken into account.

The model of "Sensory immersive VR simulation development model in procedural learning" deals with the progress of ID process in three categories as (1) virtual environment, (2) learning interface and (3) knowledge and learning. As seen in Figure 9, the proposed model consists seven main steps as analysis, storyboard, 3D design, animation, programming, application, evaluation and revise. Besides, all the steps of this 3 x 6 matrix structure are based on the evaluation and revise phase circularly in order to get reach effective VRLE. In this model could be used to design sensory immersive VRLEs that should interact with the natural user interface and teach the procedural knowledge-skills. No such ID model to develop immersive VRLEs have been found in the literature. It seems that existing models such as Dalgarno and Lee (2010) are based on theoretical bases but are not experimentally tested. The proposed model is expected to fill a gap in this sense.

Future Works

- The proposed "Sensory immersive VR simulation development model in procedural learning" should be applied and evaluated by other studies.
- Since there are no specific ID models in the design of the immersive VRLEs, ID models should be developed for the thematic design of VRLEs.
- Various ID models should be developed in accordance with the knowledge and skills to be taught for the design of VRLEs.
- Because of the participants have indicated that iterative reminders are beneficial to learn concepts, repeated reminders should be used and accessible to teach concepts in VRLEs.
- Procedural knowledge should be presented in sequential and related to VRLEs since it has been determined that they help participants to link to procedures.
- Modeling should be used and accessible for procedural learning in the VRLEs, as it has been found that participants have lack experience in the physical environment and need guidance in their faulty practice.

- A detailed guideline should be prepared and accessible to inform users about the instructional scenario and rules in order to enable participants to learn about the use of simulation.
- VR technology should be used as a reinforcer of learning process since the theoretical knowledge can be reinforced and put into practical application by the VRLE.
- Since the simulation is proven to be an effective learning tool, technologies that interact with the natural user interface should be preferred in VRLEs that will be developed to gain psychomotor skills.

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MATHEMATICS AND SCIENCE EDUCATION

THE EFFECT OF TEACHING GRAPHS OF FUNCTIONS WITH THE DIFFERENT TECHNOLOGICAL APPLICATIONS ON STUDENT ACHIEVEMENT*

Nuri Can AKSOY**

Introduction

In business life, there is a need for people who are approaching the encountered problems profoundly and who can perceive them correctly and produce appropriate solutions. In this context, the emphasis is placed on educating individuals who know the meaning of mathematics in developing countries and who have the necessary knowledge of mathematics that can adapt to the rapidly developing world (Ersoy, 2003). In the last decade, the role of technology in increasing the efficiency of teaching and learning has drawn the attention of mathematics educators, and the tendency of their work has focused on this topic.

Today, instead of known approaches, there is a very different mathematics teaching and learning perspective (NCTM, 2000).

In the realization of the changes in mathematics education, it is an important influence that the computers and the technologies that they bring with them become a part of our lives day by day.

The ability expected of students to calculate on paper in mathematics teaching has left the place for reasoning, interpretation and prediction skills (MEB, 2009, Olkun and Toluk-Uçar, 2007). Technology offers new possibilities in the acquisition of such skills (Ersoy, 2003), and technology is not the place of learning these skills, on the contrary, it makes mathematical thinking accessible to students without regard to their mathematical skill levels (Erbaş, 2005). At the same time, technology-supported mathematics teaching and learning positively affects students' ability to understand procedural exercises, understand concepts and problem-solving skills, and mental development (Ersoy, 2003). For this reason, today's mathematics teachers must have knowledge of information technology, follow technological developments and transfer it to the classroom environment (Özüsağlam, 2007). Because, in the changing world, those who do mathematics will have more alternatives to shape their future life. This suggests that students need different needs in mathematics education unlike past (Akkan and Çakıroğlu, 2011; Baki and Bell, 1997).

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Technology can be an essential and exciting tool because it allows students to explore mathematical environments and multiple representations. This tool is necessary for mathematics learning and teaching; affects the mathematics teaching environment and the mathematics learning of students positively (NCTM, 2000). Opinions about the impact of technology on mathematics learning and teaching are about how teachers need to use computers, calculators, or the Internet to increase the mathematical capacity of students (Geiger et al., 2012).

Another issue that is as important as the use of technologies and requires expertise is the use of effective technology (Yıldırım and Demir, 2015). In this context, it is necessary to develop an effective methodology to integrate technology into the teaching process, to embody abstract elements in mathematics (Farmer, 2006), to develop the skills of critical and analytical thinking (Alakoç, 2003) should be used. At the same time, educational software contributes to the visualization of mathematical concepts and provides good opportunities for teachers and students because of the more permanent and effective learning outcomes (Kutluca & Zengin, 2011; Zengin &Tatar, 2015).

Information and communication technologies (ICTs) are a force that changes our lives in many ways (Sarkar, 2012). Rouse (2005) refers to ICT as a generic term that includes any communication device or application; television, computer, network hardware and software, mobile phones, satellite systems, and all related communication devices and applications such as video conferencing and distance learning. On the other hand, Karahan (2001) defines ICT as the creation, accumulation, processing, recovery, preservation, dissemination of information and tools that help them. The Ministry of National Education (MoNE) (2013) stated in the mathematics teaching program of 9th and 12th grades that the expected achievements of the students, which are defined as "Using Information and Communication Technologies (ICT) in Place and Effectively" are using the internet in place and effectively to access the resources related to graphing calculator, spreadsheet software, dynamic mathematics / geometry software, (website, animation, practice, etc.) developed for mathematics teaching and information, video, application etc.

Given the above expressions, ICT will enable students to easily understand the conceptual basis of the learned subject through the use of multimedia and representations. At the same time, different technological products will help learners to model mathematics and geometry concepts as well as contribute to problem-solving (Karaaslan, Boz and Yıldırım, 2013).

ICT can be grouped under 5 headings for their intended use (Oldknow and Taylor, 2003):

1. Assisting teacher in lesson planning, preparation, and management, teaching assistant, 2. Apart from the normal course, students should use them individually, 3. The use of ICT by a group of students during the course, 4. Ensuring the use of ICT for the entire class, 5. Use of ICT at all grades in teaching.

The technologies that can be used in teaching can be examined under two main headings as hardware and software. As hardware, there are computers, tablets, smartphones, graphing calculators, smart boards, computing tools, digital cameras, scanners, printers, CDs. As software, there is computer and mobile device software designed for use in lessons (Geiger et al., 2012). Software such as Cabri, Geometry Sketchpad, graphing calculators and advanced computer software applications provide stronger learning environments for students (Choi-Koh, 2003).

In recent years, the use of all technologies based on computers and calculators in the field of education has been rapidly increasing in developing countries, and the use of most of these tools is becoming widespread (MoNE, 2009).

At the beginning of the 1980s, mathematics teaching was started with standard calculators and later with graphic calculators. However, with advancing technology, the current position is entirely different and advanced from the times when standard calculators were used (Karaaslan et al. l., 2013). Another product of the developments in technology is graphing calculators (GC). It is believed that these tools can be effective in teaching students to value mathematics, and in developing their mathematical thinking and reasoning skills (Baki and Bell, 1997, Baki and Çelik, 2005). To investigate the effects of GCs on students attitudes toward academic achievement and mathematics, several studies (Dunham and Dick, 1994, Hembree and Dessart, 1986, Milou, 1999, Nikolaou, 2000, Paschal, 1994, Pomerantz, 1997, Trout, 1993) have shown that the use of graphing calculators is effective in enhancing students' academic achievement in mathematics courses and in developing positive attitudes towards mathematics and computing (Baki and Çelik, 2005). These results are encouraging in the interest of mathematics educators from GC technology. Another research result (Alexander, 1993) shows that the use of GC is not effective in increasing students' attitudes towards academic achievement or mathematics.

There is a lot of dynamic software that can teach and learn math in the computer environment. One of these dynamic software, Excel, can show the relationship between geometric forms and some topics in mathematics (Aksoy, Çalık, and Çınar, 2012).When the literature is examined, studies indicating that computer-assisted instruction on "Function and Graph Drawing" affects student success positively are found. (Genel, 1999;

Aksoy, Çalık and Çınar, 2012). Again, in Baki and Öztekin's (2003) study on "Function and Graphics Drawing," a material was prepared in the Excel program, and the opinions of the teachers were taken. According to this, teachers have touched on the fact that the material will make the mathematics lessons fun, attract the attention of students, create permanent information on the students, guide them to the research on the topic and lead them to interpret the finding, and reduce the teacher's responsibility. They also stated that this software could be used to enrich mathematics courses.

Mobile computing is one of the technological innovations that has become an integral part of our lives in recent years, and perhaps it is at the foremost. Increasing application variability and technical strength of mobile devices (smartphones, notebooks, and tablets) provide great convenience in our lives. Mobile technologies and applications, while relatively new in the digital world, offer new opportunities to reinvigorate some aspects of the mathematics learning experience and increase students' mathematical thinking and attendance. In addition to providing visual and dynamic ease, touch screens provide direct interaction with mathematical phenomena. This mobile convenience allows easy transfer between different learning environments and also allows students to find more flexible ways to work collaboratively (Larkin and Cardel, 2015).

In computer-aided mathematics teaching, especially in graphical drawing, computer, GC, and mobile application tools have comparable features over different dimensions. While mobile applications are provided via mobile phones, the GC also needs to be purchased separately. For computer-based applications, a classroom environment with a computer lab or computer infrastructure is required for the teaching environment. Regarding accessibility, mobile applications are expected to stand out because individuals' mobile phones are always next to them; the screen size and the keyboard make it easier to use the computer.

When the literature is examined, it is stated that the technological tools used in many studies in mathematics teaching have an effect on students' learning. (Doğan, 2012, Ersoy, 2003, Erbas, 2005, Gündüz, Emlek and Bozkurt, 2008, Kay, 2006, Kutluca and Baki, 2015, NTCM, 2000, Ralston, 2007, Richardson, 2009, Taşlıbeyaz and Gülcü, 2013). However, in the literature, no similar studies have been found regarding how the learning opportunities that different technological tools or applications are providing us with the rapid progress of technology affect students' success.

It has been demonstrated in previous studies that technology has embodied the knowledge of students in the field of education, especially regarding drawing graphics in teaching mathematics, providing meaningful learning and increasing permanence. Moreover, technological

tools and applications are in different formats and create different needs for educators. For example, GC requires applications via computers or mobile devices, and the initial investment cost to procure all of them. However, different variables, such as the cost of the technological tool, which is more easily accessible in itself, more suitable to use in teaching, may influence the choice to be made among the technological tools in drawing the function graphs. The research has not found any research that investigates "the effect of three technological tools, which differ in many ways that can be used during the teaching process for drawing functional graphic, on student success" in the literature of mathematics teaching. Furthermore, research is crucial in order to adapt the teaching opportunities of today's technologies and to support the FATIH Project conducted by MoNE.

Purpose of the Research

The purpose of this study is to demonstrate the effect of different technological applications on the achievements of students in the drawing of function graphs in mathematics teaching.

Problem of the Research

This study has been shaped by two problems. First, "what is the effect of technological applications (Excel, GC, and mobile application) on the achievement of students in the drawing of function graphs in mathematics teaching?" The second problem is, "What are the views of students towards the use of Excel, GC and mobile application in teaching functional graphics drawings?"

Method

In the study, the mixed method was used. The mixed method was formed by combining quantitative and qualitative research methods in different ways. In mixed methods, triangulation pattern was used. By using quantitative and qualitative methods in the variation pattern, it was aimed to complete the weaknesses of one method with the strengths of the other method (Creswell, 2011, Yıldırım and Şimşek, 2013). The quantitative part of the research was weak experimental design. The semi-structured interview was conducted in the qualitative part. The qualitative section aimed to support the quantitative part.

The research was carried out with the first grade mathematics teachers of a state university in the first year of 2015 - 2016 fall semester of primary school mathematics teacher education because students take general mathematics course and the basis of other mathematics courses of general mathematics course. This study was carried out in the general mathematics course on the teaching of functions and inverse function graphs such as $y = a$, $y = ax + b$, $y = ax^2 + bx + c$, $y = x^a$, $y = a^x$. In the study, "conformity

sampling method" (Cresswell, 2015) was used for purposeful sampling methods. It can be predicted that students are at the same level of knowledge because they state preference with their license placement scores in Turkey.

At the beginning of the application, students were randomly divided into three groups. Each of these three groups was trained in software and devices for drawing and using function graphics for four hours a week. In the first group, with the help of Excel program, in the second group with GC, and in the last group, a graphic drawing mobile application that students downloaded to individual smartphones was performed. All of the trainings were conducted by the researcher in a face-to-face classroom setting.

At the beginning of the study, the achievement test was conducted as a pilot study on 50 students who were studying in the second grade of mathematics teacher education program. After the pilot study, it was understood that the "success test" should include general forms in order to facilitate understanding of the special forms of the functions. This information was also supported by the five expert interviews on the "success test. "The "success test" has been finalized in the direction of the feedbacks. In addition, during the group study, the students' comments and answers about the graphics were recorded in writing. After the training, group interviews were conducted and each's Excel, GC and mobile applications were consulted about their impact on the success of the students.

In the study, a pre-test and a pre-test parallel post-test developed by the researchers in order to determine each group performance before and after the application for the drawing of the function graphs were applied. The "success test" consists of open-ended sub-questions for each question that graphs the graphs of the different forms of the function and measures the interpretation power of the student.

The classroom discussions and responses of the students were observed by two field experts, and semi-structured interviews were conducted with the students.

A semi-structured interview form was used to collect the data. The interview form was conducted with a pilot study with one student. As a result of interviews with prospective mathematics teachers and their proposal and review of the relevant literature, a data collection tool was prepared. The views of expert lecturers were consulted in order to ensure the validity of the data collection tool. In line with these views, some changes were made regarding expressions in the interview form, and it was made ready for implementation. Interviews were recorded in written forms.

In the quantitative part of the study, pre-test and post-test academic achievement tests were applied to the students in three experimental groups and three methods, and the effects of the methods on the achievement of the students were analyzed by Wilcoxon Marked Rank Test. Also, the difference (access) between the pre-test and post-test scores of the experimental groups was calculated after the application. Before the analysis, normality (Shapiro-Wilks test) and homogeneity (Levene test) tests were performed to determine whether the parametric test assumptions were met. As a result of the analyzes, it was determined that the gain score of all experimental groups have a normal distribution ($0.89 \leq S\text{-}W \leq 0.98$, $p > 0.05$) and that the variances were homogeneous ($F = 0.437$; $p > 0.05$). One-way analysis of variance (ANOVA) was used to determine whether there was a statistically significant difference between the access scores of the experimental groups.

In the qualitative part of the study, content analysis was used from qualitative data analysis methods. In content analysis, similar data are gathered together by certain concepts and themes and interpreted in a way that the reader can understand (Yıldırım and Şimşek, 2013). The relationships between the categories obtained as a result of the content analysis and the subcategories and the relationship between each category and the other categories were checked, and integrity is provided. In order to increase the reliability of the study, some candidates' views on the category and subcategories were given directly. Also, prospective teachers are coded Ö1, Ö2, Ö3,...Two researchers (researcher diversity) read responses of the candidates and collect them under specific categories. By determining the standard categorization of the comparison result, the coding consistency of the researchers was determined; that is, the percent of correspondence (Miles and Huberman, 1994). For the first group, the percentage of correspondence was 75%, for the second group 100%, and for the third group 80%. These values show that the coding reliability of the researcher may be acceptable.

Findings

In this part of the study of "the effects of different technological applications on the achievement of the student's function graphs in mathematics teaching," the analysis and interpretation of the data on the sub-problem were included. The sub-problem of the study is stated as "Is there any effect on student achievement of teaching with Excel, GC and Mobile application in drawings of graphs of some functions in general mathematics lesson of primary school mathematics teachers?" Moreover, the results of the analysis related to sub-problem were given in Table 1.

According to Table 1, there is a statistically significant difference ($Z = -2{,}807$; $p = .005 < .05$) between pre-test post-test math achievement scores

of the students in group 1. Accordingly, there was a significant positive increase in the post-test math achievement scores of students after the experiment.

Table 1. Wilcoxon Marked Rank Test Results for Comparison of Pre-Test and Post-Test Mathematics Academic Achievement Scores of Students in Group-1 (Excel)

Post-Test - Pre-Test	N	Mean Rank	Rank Sum	Z	p
Negative Rank	0	0	0	-2.807	.005
Positive Rank	10	5,50	55		
Equal	0				

There is a significant difference since * p <.05

According to Table 2, there is a statistically significant difference (Z = -2,803; p = .005 <.05) between pre-test post-test math achievement scores of the students in the experimental group. Accordingly, there was a significant positive increase in the post-test math achievement scores of students after the experiment.

Table 2: Wilcoxon Marked Rank Test Results for Comparing Pre-Test - Last Test Mathematics Academic Achievement Points of Group-2 Students (GC)

Post-Test - Pre-Test	N	Mean Rank	Rank Sum	Z	p
Negative Rank	0	0	0	-2.803	.005
Positive Rank	10	5,50	55		
Equal	0				

There is a significant difference since * p <.05

According to Table 3, there is a statistically significant difference (Z = -2,499; p = .012 <.05) between pre-test and post-test math achievement scores of students in the experimental group. Accordingly, there was a significant positive increase in the post-test math achievement scores of students after the experiment.

Table 3: Wilcoxon Marked Rank Test Results for Comparing Pre-Test - Last Test Mathematics Academic Points of Group-3 Students (Mobile Application)

Post-Test - Pre-Test	N	Mean Rank	Rank Sum	Z	p
Negative Rank	2	1,50	3	-2.499	.012
Positive Rank	8	6,50	52		
Equal	0				

There is a significant difference since * p <.05

When Table 4 is examined, it is seen that there is no statistically significant difference between the access points of the experimental groups in the one-way ANOVA (F = 0.439, p> 0.05). However, it can be said that the gain score means of the experimental groups are in favor of group 2.

Table 4. One-Way ANOVA Test Results Regarding Inter-Group Gain Scores

Score	**Group**	**N**	***Mean± SD***	***F***	***%95 CI***	***Influence Quantity***
	1	10	18.70±11.32		10.76-26.63	
Gain	2	10	21.70±10.56	0.439	13.76-29.63	0.03
	3	10	16.60±14.46		8.66-24.53	

The second problem of the research is stated as "What are the opinions of the students about the use of Excel, GC and mobile application in the teaching of the drawings of the graphs of some functions in the general mathematics lesson of prospective primary mathematics teachers" and the analysis results related to the sub-problem are given in Table 5.

When Table 5 is examined, it was seen that the opinions of students about the use of Excel, GC, and mobile application are classified into 3 categories under Graphic Drawing theme. The Excel category consists of only one subcategory of positive opinions. In the subcategory of positive opinions, five of the students referred to "performing quick solutions, resulting in practicality"; Four of the students referred to "being aware of transactions, learning by understanding transactions." One of the students emphasized memorability and, as a result of that, remembering the visuals of general forms. Some student views on this subcategory are as follows:

"I noticed my mistakes and faults after the application. In this respect, the post-test was easier, and I tried to produce practical solutions. In this regard, it was a nice process for me "(S2)

"I was able to answer 5 questions in the pre-test and 5 questions in the post-test, but in the post-test, I answered the questions in a shorter period and responded by realizing the questions, and I believe that I answered it more accurate" (Ö4) and *"The rationale behind drawing the graph has become more permanent"* (Ö5).

The GC category consists of two subcategories, positive and negative. In the positive opinions subcategory, 5 of the students stated that it is helpful to achieve fast solutions and as a result help them to become more practical. Also, 5 of the students emphasize the development of interpretive skills, and as a result the development of visual memories. Some student views on this subcategory are as follows:

"After the performance with the calculator, I started to visualize them in my head and interpreted the graphics easier, which positively affected me in comparison" (S14)

"We had a great time having fun with the calculator, and there were still images in our visual memory. It was easier for me to comment and draw the figures than I did because I remembered the figures" (S20).

In the sub-categorization of negative opinions, one of the students stated that there is no change. The student opinion was: *"I am not sure that whether there is something that is changing" (S17).*

Table 5. Student Opinions on Excel, GC and Mobile Application Usage

Theme	Category	Subcategory	Codes		
Graphic Drawing	Excel	Positive Opinion	Fast solving (f=5; %50)	The cause	Acquiring practicality
			Being aware of the transactions (f=4; %40)		Learning with understanding
			Memorability(f=1; %10)		Remembering the visuals of common forms
	GC	Positive Opinion	The development of the ability to comment (f=5; %50)		Development of visual memory (retention)
			Fast solving (f=5; %50)		Acquiring practicality
		Negative Opinion	No change (f=1; %10)		Experience - Readiness
	Mobile Application	Positive Opinion	The development of the ability to comment (f=7;%70)		Development of visual memory (retention)
			Fast solving (f=2; %20)		Acquiring practicality
			Being aware of the		Learning with understanding

		transactions (f=2; %20)	
	Negative Opinion	Fast solving(f=2 ; %20)	Disbelief in its contribution

The Mobile Application category consists of two subcategories, positive and negative opinions. In the sub-category of positive opinions, the majority of the students (7 people) referred to the development of their ability to interpret, thereby causing the development of visual memories. Two of the students emphasized fast solving, resulting in practicality. Also, two of the students emphasized the awareness of the transactions, therefore, to learn transactions with understanding. Some student views on this subcategory are as follows:

"*When I first solved them, I draw more graphics, so I solved more questions, but I had difficulty in commenting. I think I made more accurate comments after the application*" *(S21),*

"*I solved them more confidently. I could write comments. When I first solve them, I could not write comments*" *(S28)* and

"*I solved one more question than I did in the first time, the only difference was that I solved it faster and a little more conscious*" *(S29).*

In the negative opinions sub-category, one of the students referred to no change. The student opinion was: *"I wrote the same in the second as I did in the first application. There was no change "(S26).*

To sum up, students in the Excel group performed fast solving; in the GC group students fast solving and development of interpretive skills were emphasized; and in the Mobile Application group, elements such as "the development of interpretive skills" came to the forefront.

Discussion and Conclusion

Baki and Öztekin (2003) found that the software developed using Excel in order to enrich the teaching was found appropriate according to the teachers' opinions. Aksoy, Çalık, Çinar (2012) in their study of drawing graphs of functions with Excel, they stated that student achievement in the groups that were taught by Excel was statistically significant compared to control groups. The finding of the previous studies is supported by student opinions in the study. When the pre-test and post-test scores of the group in which the instruction was performed with Excel were compared, it was concluded that there was a statistically significant difference. In teaching with Excel, while the presentation of the difference between the coefficients and the variables by the teacher and the difference between the

previous and next drawn graphs in a function which is in the general form creates a difference in time, the fact that students are able to show the difference between the two graphs within a short period, which also allows them to discuss. Moreover, more than one graph of the function in the same form could be presented in a short time.

It was concluded that there was a statistically significant difference between the pre-test and post-test mathematics academic achievement scores in the group that was being taught by GC. In their study with teachers, Baki and Çelik (2005) reported that after the course they introduced GC, many of the teachers suggested that this technology would draw students' attention, to provide effective and lasting learning, and to encourage students to research, therefore, would be beneficial to use in mathematics lessons. In support of this study, it has been an excitement for the students to be able to see the devices for the first time since the GCs were given to the students. They have started to recognize the device immediately and have started to use it shortly. By entering functions with the same general form in the device, students have the opportunity to compare the graphics drawn in different colors on the same screen when they want to draw their graphics which increased the students' ability to interpret the graphics as it was supported by the opinions of the students. Graphics are easily placed in visual memories of students as photographs. Furthermore, the device which allows students to shape the coefficients and constants of a "function given a generic form according to their preferences enable the students to compare their graphs with other peers that provide individual learning. However, when using the device, it is difficult to use more than one button when the screen image is requested to zoom in or out, and this operation cannot be performed effectively. This makes it difficult for the students to analyze the difference between the graphs that do not fit on the screen or the graphs of the functions that are close to each other.

It is seen that there is a statistically significant difference in mathematics academic achievement pre-test and post-test scores in the group in which "mobile application" is taught. The mobile applications make a qualified tool for use in mathematics teaching because students have individual mobile devices, a graphical drawing application developed in the application pool and this application can be downloaded free of charge to mobile devices via the internet. Students have been able to draw the coefficients and fixed values of the functions given in the general form with up to three different functions and draw their graphics as they desire. The application shows the three different functions in three different colors and shows how the three functions are represented at the bottom of the screen so that students can easily compare and interpret the function graphs. This view is supported by the expressions of the students. Students

expressed that their skills of interpreting the function graphs have improved and that they achieved faster graph drawing with the mobile application. In practice, as the zooming in/out of the image is easily accomplished with two fingers, it is easy to analyze values that are very close to each other or those that do not fit on the screen.

As a result, groups were found to have a statistically significant increase in the mean of the post-test achievement scores in each group independently of each other in regard to the mean of pre-test achievement scores. There was no statistically significant difference between the access scores of the experimental groups. However, it can be said that the gain means of the experimental groups are in favor of group 2 GC. In this case, when the averages are examined in the group order (18, 21, 16), the second group in which the GC application is performed is more foreground than the other groups. The reason why this does not make a statistical difference is that the number of students in the groups is small.

In interviews with students, students stated that using technology in the education made it easy to make sense of graphical drawings. Groups that were educated with GC and mobile application stated that their learning through personal experimentation with individual devices positively influenced their participation in the course and they felt more active. The students said that representing the graphics of the functions performed in the mobile application in different colors on the same screen, the ability to compare three functions that can be entered on the same screen, and the ability to zoom in/out the screen provides a better reading of the graph.

As a result of the study, mobile applications for teaching mathematics can be developed because of the possibility to use an individual smartphone in classroom application, easy access, free and convenient to individual learning speed. The research can be repeated on different topics in mathematics teaching with the same technological tools or a similar study at different learning levels. In addition, research can be conducted on the in-class and out-of-class availability of these applications. The effect on the cognitive and affective characteristics of the students can also be investigated.

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MUSIC EDUCATION

STRATEGIES USED BY CELLO STUDENTS WHILE PERFORMING TURKISH MUSIC PIECES

Burcu AVCI AKBEL*

Introduction

The inadequacy of the conventional instructional method which follows an instructor-oriented approach and ignores individual differences in learning has led to exploration and implementation of new approaches in the field of educational sciences. There are quite a large number of studies carried out in the recent years on the quickest and the most effective way of learning. "Education and training are now considered as a process of facilitating learning and helping the student in structuring their own knowledge, sense-making or interpretation in respect of the outer world during their learning" (Sünbül, 2011: 146). This is more clearly the case with music education institutions, and more particularly with individual instrument classes. Individual differences should be taken into consideration in individual instrument classes; the strategies chosen by students in the process of performing the instrument, the circumstances in which they choose such strategies and the conditions under which they can learn better should be elaborated on. Indeed, the techniques and strategies used by students when playing their instruments significantly influence their performance and progress. Strategy generally refers to a path followed to achieve something or implementation of a plan developed to reach a goal (Açıkgöz, 1996). In line with this definition, instrument playing strategy can be defined as the path followed to be able to play an instrument or implementation of the plans developed. It has been observed that cello students studying Turkish Music education refer to numerous ways in order to be able to display a good instrumental performance. This study is based upon the fact that students follow a variety of different pathways by making different plans to attain the same goal.

The aim in the first year of the cello education provided at Turkish Music conservatories is to ensure that the student is equipped with fundamental technical knowledge. Whereas, Turkish Music pitches, Turkish Music *usul*s, Turkish Music *maqam*s, individual characteristics - style elements are in the forefront during subsequent years of cello education. In this sense, cello classes are usually held by performing Turkish Music pieces - paying regard to the mentioned points -. However, the fact that Turkish Music pieces are not composed specifically for one instrument and there are no methods or certain absolute rules for cello

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education in Turkish Music requires development of a number of strategies to perform the pieces on the cello. Therefore, it has been revealed that students determine and/or use strategies for performing Turkish Music pieces in addition to the learning strategies known in the literature. At this point, it is of importance to reveal the strategies determined and used by students in the performing process.

There are numerous studies in the literature on the learning strategies used by musicians (Weinstein & Mayer, 1986; Kocabaş, 1995; Nielsen, 1999a; Nielsen, 1999b; Maris, 2000; Hagans, 2004; Cangro, 2004; Nielsen, 2008; Yokuş, 2009; Uygun and Kılınçer, 2012; Akın, 2013; Deniz, 2015; Kocaarslan, 2016; Uygun and Kılınçer, 2018). In addition to the studies on the learning strategies, there are also studies performed on the strategies used by musicians in hearing (Seppänen, Brattico & Tervaniemi, 2007) or music practice or performance (Geiersbach, 2000; Hanberry, 2004; Jørgensen, 2004; Martin, 2005; Kenny, 2006; Nielsen, 2004; Sikes, 2013). However, despite the very few studies in the literature on the use of strategies in Turkish Music (Uygun, 2017), no study has been found in respect of the strategies used in performance of Turkish Music pieces on the cello. This study is based upon the argument that there are few and deficient studies on the use of strategies in the field of instrumental performance in Turkish Music, and it is aimed at revealing, examining and assessing the strategies used by students while playing the cello.

Quantitative research method is usually employed for the studies in this field. (Akın, 2013; Çelikkaya, 2010; Karasakaloğlu, 2012; Kuzu, Balaman and Canpolat, 2014; Şara, 2012). Additionally, there are studies structured as a form of qualitative analysis. (Taşçı and Soran, 2012; Altıntaş, Kabaran and Kabaran, 2016). The questions of which strategies are determined and/or used for cello performance in Turkish Music, in which circumstances and how the determined strategies are used can only be answered through a qualitative research. Therefore, this study is structured as a qualitative study. The study has primarily revealed the strategies used by students; the data obtained were subject to an in-depth analysis on the basis of both students and groups categorized by level of instrumental control.

2. Purpose of Study

This study is aimed at identifying the cello playing strategies used by cello students studying at Turkish Music Conservatories and revealing how learning happens by this way and what pathways are followed during learning. Thus, the aim is to contribute to the progress of students who know or are capable of thinking on by which method and how they need to play their instrument, and can achieve success in a quick and effective

manner by using strategies. In this context, answers are sought to the following questions: As for students,

- What are the problems and challenges they encounter when performing Turkish Music pieces?
- What are the performance strategies they develop or use for mitigating the challenges experienced or correcting the mistakes done?
- What are the performance strategies they develop or use in order to be capable of performing at an advanced level?

3. Methodology

3.1. Research Pattern

This research is a case study. According to Merriam (1988), case study is one of the systematic types of pattern involving collection, organization and interpretation of data and access to research findings. Köklü (1994) examined case studies in four categories, which are: ethnographic, evaluative, instructional and actional. This research can be classified as an instructional case study.

3.2. Study Group

The study group consists of nine cello students studying Turkish Music education. Maximum variation sampling, which is a purposeful sampling strategy, is used in the study. The basic purpose of use of this sampling method is "to reveal common or divergent aspects between varying circumstances which are determined to be consistent with the purpose of the study and thus to describe the problem in a wider framework" (Büyüköztürk et al., 2010). Sampling variation in this study is provided by creating a study group consisting of cello students of different ages, genders and instrumental control levels studying at different classes in different regions of Turkey. The study group consists of three different levels in terms of instrumental control, which are beginner level (G1, G2, G3), intermediate level (G4, G5, G6) and advanced level (G7, G8, G9).

Table 1. *Details of participants*

Participant's Identification Code	Date of Birth	Region in which their University is Located	Gender	Professional Experience	Date of Interview
G1	1994	Southeastern Anatolia Region	Female	Undergraduate 3	29.06.2018
G2	1997	Southeastern Anatolia Region	Female	Undergraduate 1	02-03.07.2018
G3	1995	Southeastern Anatolia Region	Male	Undergraduate 2	04.07.2018
G4	1994	Central Anatolian Region	Female	Undergraduate 3	18-25.05.2018

G5	1993	Central Anatolian Region	Female	Undergraduate 4	25.05.2018
G6	1989	Central Anatolian Region	Female	Undergraduate 4	11-25.05.2018
G7	1993	Aegean Region	Female	Graduate	18.06.2018
G8	1985	Aegean Region	Male	Undergraduate 4	28.06.2018
G9	1990	Aegean Region	Male	Graduate	26.06.2018

Note: All participants are studying in universities in Turkey.

3.3. Collection of Data

Interview technique and think-aloud technique is used in the examination of cello playing strategies of the students studying Turkish Music education. Steward and Cash (1985) describe the interview technique as "a reciprocal and interactive process of communication which is predetermined and held for a serious purpose and based on questioning and answering". The semi-structured interview technique prepared by the researcher was used in this study; audio recordings of the interviews held were made via a voice recorder - the participants were asked for their consent earlier- .

The think-aloud technique is commonly used in the assessment of cognitive and meta-cognitive strategies. The think-aloud technique is described as an evaluation technique by which participants directly and verbally express their opinions during the tasks they were given. (Swanson, 1990; Sweeney, 2010; Veenman and Spaans, 2005). Video recording of the students was made as they deciphered a musical piece that they were unfamiliar with. After the recording, the students were asked to watch the video record and to express their opinions, which was also recorded. An audio recording of the opinions expressed by the students while watching their own video recording was made - the participants were asked for their consent earlier-.

3.4. Analysis of Data

Voice records of the interviews took approximately 20-25 minutes. The audio recordings both during the interview and think-aloud processes were transcribed. The data acquired were analyzed through content analysis method. Content analysis is defined as "a careful, detailed and systematic review of a specific material in order to identify patterns, themes, biases and meanings". (Berg & Latin, 2008; Leedy & Ormrod, 2005; Neuendorf, 2002). ATLAS.ti8 qualitative data analysis software was used for the analysis of qualitative data.

4. Findings

The findings obtained in scope of this study are analyzed under two themes as the strategies to mitigate the challenges experienced and the advanced level performance strategies.

4. 1. Strategies to Mitigate the Challenges Encountered

This section reveals the situations or subjects in which the participants most often encounter challenges, make mistakes and have difficulties while performing Turkish Music pieces on the cello and which strategies and techniques they use to solve such problems regarding the said subjects, situations or passages. The categories examined under this theme are listed from the highest to the lowest number of strategies developed for them.

4.1.1. Strategies to Mitigate Challenges in Certain Parts

The strategies to mitigate challenges in certain parts are most commonly addressed by students; a high number of strategies are developed on this subject. With regard to the subject, G1 stated that she has too much difficulty with 'transposition' and 'performing Turkish Music pitches properly', that she needs to listen to the related genre of music and practice etudes a lot to overcome this problem; but she cannot do it - as she does not like Turkish Music -. G2 and G3 stated that they have a quite systematic progress in performing the pieces, therefore they cannot provide the musicality required for the pieces. Although the mentioned students think that what they primarily need to do in order to overcome such problems is to listen to the related genre of music, they reported that they do not adequately listen to that genre.

G4 has difficulty with playing open positions, certain *usul*s and rhythms, slowing down the tempo and playing the nuances. In order to overcome the said problems, G4 usually refers to a number of ways such as trying to find the same note on high and low pitches, making lots of repetitions, practicing chords, practicing with a metronome and listening. G5 has difficulty with open positions, transitions between positions, 5. 6. 7. positions and correct intonation. In order to overcome the said problems, G5 refers to a number of ways such as practicing by going through line by line and bar by bar, practicing at a slower tempo, making repetitions, practicing the difficult part on low pitches which she feels she has more control on, practicing with a metronome, focusing on practicing other parts to forget the challenging part and then turning back to that challenging part. G6 stated that she has problems with open positions, correct intonation, certain *usul*s and rhythms, the fourth position and agility. In order to overcome the said problems, G6 refers to a number of ways such as practicing section by section, practicing at a slower tempo, practicing solfege, continuously counting inside, avoiding open positions as much as possible, influencing her mental state by the thought that she will be able to overcome those problems, intensely practicing on the problematic part and repeating that part after correcting it, noting down the problematic part and making mental repetitions. When G6 was asked why she avoided using open positions, she stated as follows: "I usually change positions without

using open positions. For half positions, I prefer changing positions in order to avoid open positions; this may cause notes to become sharp as they are close to each other." Regarding taking breaks, G6 stated: "I think that taking breaks is good for mind and muscles. I do not take a break before a 45- 50 minute practice ends unless I have pain in my muscles; but I certainly do take a break if I have failed to make progress in a particular segment and I have overpracticed it. I certainly do better when I turn back to that problematic part after taking a break." It can be concluded from this statement that the student G6 knows herself well, she is capable of thinking strategically to solve the problems she experienced and implementing the strategies she developed. As it will be understood from the foregoing statements, intermediate level students developed strategies in technical, musical and motivational terms.

G7 stated that she has difficulty with transposition of Hüzzam *maqam* and *taksim* performances. G7 reported that she refers to a number of ways for solution of the said problems, such as practicing the challenging part at a slower tempo, practicing with different motifs, making repetitions on the part where she makes mistakes, listening to the related genre, memorizing *taksim*s and imitating. To clarify G7's expression "practicing with different motifs", it is worth noting her opinions on the subject. G7 explained it as follows: "I sometimes practice the parts that I have difficulty with by using different motifs. For example, I can play eighth or fourth notes instead of sixteenth notes. I apply this method to fix rhythm problems, and avoid monotony and getting bored". G8 stated that he has difficulty with the seventh position and thumb positions. In order to facilitate such problematic parts, G8 refers to a number of ways such as practicing pieces containing similar type of challenging parts, making repetitions, memorizing and practicing section by section. G9 stated that he may experience problems with deciphering pieces in *maqam*s that he is unfamiliar with, or certain rhythms and written legatos. Regarding the solutions he applies to make the problematic parts easier, G9 stated as follows: "I practice problematic parts by repeating them, trying different bowing styles, different finger numbers and different rhythms - dotted eighths or fourths - for those parts. I start playing the problematic parts at a very slow tempo and then gradually speed up. Also I sometimes practice with a metronome.". With regard to legatos, G9 said that he initially perform the entire piece by using the detaché technique first and then legatos. It is noteworthy that advanced level students report a number of technical difficulties rather than musical challenges. On basis of the foregoing, it can be said that the strategies developed for musical performance by advanced level students, who develop a large number of strategies for that purpose, help them achieve successful results.

4.1.2. Strategies to Correct Intonation Mistakes

During the interviews held, it was revealed that beginner and intermediate level students not only encounter intonation problems but also fail to notice such intonation problems. For example, G2 stated that: "I sometimes can't notice my mistakes and incorrect intonations. Then I use a tuner to play the notes by checking them". G3 stated that: "To make sure that I play with correct intonation, I accompany records of some musical pieces and I record my own performance. I can hear the incorrect intonations better when I listen to my recorded performance. I listen to the same incorrect part over and over to train my ear for the right notes. I repeat playing that one specific part from the beginning until I play it correctly." As is seen, beginner level students rather focus on noticing intonation problems. Regarding the subject, G4 stated as follows: "While tuning the instrument and practicing, I sometimes try to find the perfect tune by playing some incorrect pitches. I mean, there are times when I try to find the correct note trying lots of other notes and moving my fingers on the fingerboard. And playing chords help me find the correct intonation". From the above mentioned statements of G4, it is concluded that she is still having problems mastering the left hand position patterns and experiencing technical challenges. Regarding the same subject, G6 reported that she plays the parts with intonation problems over and over and finally she can correct the intonation on that part if she remains patient enough to repeat that specific part until she gets the perfect pitch. Like G6, G5 also corrects the intonation problems through repetition method. However, G6 indicated that, in addition to repetition, she also uses strategies such as recording her performance and checking the notes on the closed positions by comparing them to the same notes on the open position, and she finds this strategy quite helpful in correcting the intonation. On the other hand, it was revealed that advanced level cello students do not encounter too much intonation problems.

4.1.3. Strategies to Correct Rhythm - *Usul* Mistakes

*Usul*s and rhythms of Turkish Music usually constitute a challenge for students. The interviewed students use different strategies to correct the rhythms and *usul*s which they have difficulty with. For example, G1 said: "I ask my instructor for help in correcting difficult rhythms, and listen to my instructor's performance to correct my mistakes." G3 reported his opinion as follows: "I imitate. When I incorrectly play what I hear, I listen to a record of that piece and correct my mistake by viewing and hearing its rhythm as it is supposed to be." As is seen, beginner level cello students experience problems with rhythms and *usul*s and try to solve such problems by asking their instructor, listening and imitating. G4 stated that she performs *usul*s by practicing solfege to overcome the difficulties she

experiences in rhythms and *usul*s, while G5 prefers correcting the problematic parts through repetition. Regarding the same subject, G6 reported as follows: “Recording helps me notice and correct my rhythmic imperfections. And if I prepare for a piece containing quite different rhythms, I certainly listen to that piece earlier. Finally, I think that listening to and accompanying pieces will contribute to mastering the *usul* in the piece.”. During the interviews, it was revealed that all of the intermediate level cello students experience problems with *usul*s and rhythms. However, G6 was found out to use more strategies than her other friends and prefer solving her problems in a quicker and rational manner. Advanced level students reported that they usually do not experience problems with *usul*s.

4.1.4. Strategies to Overcome Technical Difficulties

It was revealed that strategies to overcome problems related to violoncello technique are most commonly developed by intermediate level students. As the beginner level students have not completed their education in terms of cello technique, they are not competent enough to develop a strategy on the subject, and this is considered as the reason why they did not declare any opinion on the subject. Of the beginner level students, only G2 stated opinion on posture - holding. G2 stated that her wrist pain makes her understand that she has incorrect posture - hold; and that she practices in front of a mirror and does finger exercises as a strategy to correct the posture and hold. With regard to incorrect posture - hold, G5 stated: “While playing, I try to make sure that I hold my hand, arm and elbow in a correct position. When I apparently have an incorrect posture or hold, which I will already feel, I pay attention to ensuring correct posture and hold”. G6 reported that she watched videos of professional cellists and kept their posture and hold in her visual memory, and tried to correct her mistakes by comparing those visual images to her own posture and hold while practicing in front of a mirror.

With regard to technical problems, G4 reported: “I don’t try hard to solve my technical problems. I feel as if they would require me to practice a lot on them, and they really do”. This statement of G4 can be interpreted to conclude that she does not consider technical practice important or she does not want to exert effort. G6 reported: “I know my technical mistakes but I can’t correct them when playing the cello. I think that the way to overcome technical flaws is to practice etudes. I can’t specifically focus on the technique while performing the pieces. I have more time to think about the technical requirements that I need to fulfill in boring passages of etudes". G6 often mentioned during the interview that she considers technical practice important. To overcome her technical problems, G6 follows the strategy of thinking over practicing etudes and technical

requirements that she needs to fulfill. It was revealed that advanced level cello students do not experience too much technical problems.

4.2. Advanced Level Playing Strategies

According to the data obtained from the interviews, advanced performance strategies are categorized under three themes, which are: 'strategies related to the factors determined by the performer', 'strategies related to musical performance ability' and 'time saving strategies'. These categories are examined by listing them from the highest to the lowest number of strategies used for them.

4.2.1. Strategies Related to the Factors Determined by the Performer

As Turkish Music pieces are not composed for a specific instrument, instrumental characteristics are determined by the performer before or during the performance. On basis of the information acquired from the interviews held under this study, the category of 'factors determined by the performer' is examined under two sub-categories as 'writing finger numbers' and 'writing legatos'. It was found out that the categories of writing finger numbers and writing legatos are considered by students as achievements requiring high skills. Beginner level students reported that positions, finger numbers and legatos are usually determined by their instructors and thus the students themselves could not develop a strategy on the subject.

4.2.1.1. Finger Number Writing Strategies

This is the category which is most commonly addressed, coded and subject to the highest number of strategies used. This section will examine which factors are taken into consideration by the participants in writing the finger numbers and which strategies they use. On this subject, G4 reported: "I try to find the positions on basis of minimum movement. For example, I choose random positions in my mind for a specific musical piece and write down the finger numbers on the note. I further think about which other positions might be feasible. I replace the technically poor positions by more feasible ones". G4 finds the finger numbers by trial and error method on basis of the 'minimum movement' principle. On the same subject, G5 stated as follows: "While determining the finger numbers, I take minimum effort as basis, as a hard position already sounds bad. While playing, I try to determine the finger numbers that offer most effortless and easiest playing experience. When writing the positions, I usually think like 'the positions should be comfortable, they should not require too many transitions from note to note with an intervening silence, the notes should be tied together', and so on." With the expression 'effortless', G5 means ease of movement rather than minimum movement in transition between

positions. The foregoing statements manifest that G5 takes ease of transition between positions and smoothness of movements into consideration. Like G4, G6 also reported that she determines finger numbers by trial and error method and plays the same bar over and over again in order to find the correct finger numbers. Unlike the other participants, G6 stated: "I take a number of factors into account while writing the finger numbers, such as whether a piece starting from Neva pitch goes to Gerdaniye pitch or makes a progression to the resting note. ". This statement of G6, indicating that she writes the finger numbers by paying attention to which pitches the piece the musical piece moves on and to the distance between the notes, shows that she is using an advanced level strategy on this subject.

All of the advanced level cello students mentioned about the finger number writing strategies that they often use during the interviews. G7 writes finger numbers by using strategies such as taking the instructor's lessons as examples, easiness, avoiding open positions as much as possible, etc.. As is seen, G7 aims to achieve a good sound as well as positions that can be easily played. On the subject, G8 reported: "I am careful not to steer away from Western music. I pay effort to use as many positions as possible. I think the 1st position alone is not appropriate for academic performance. I try to avoid playing the notes on open strings - although it is easier to do - as they don't have a good timbre. I care about academic performance and good timbre". It is remarkable that G8 used the expression 'academic performance' a lot and often stated that playing the notes on the 1st position is not appropriate for academic performance. From the questions directed, it was understood that this expression stated by G8 refers to 'the ability to effectively use the techniques taught in Western Music'. It was revealed that G8 considers musical performance to be of higher importance than easiness in writing finger numbers and he follows a strategy which involves using as diverse positions as possible. Finally, G9 reported that he writes finger numbers by taking into consideration the factors such as easiness and playing legato, and determines the positions by sureness about (the individual's control over) the position and integrity of the meaning. In order to play the notes rather in a legato style, G9 follows a number of ways such as avoiding too much transition between strings, and preparing the left hand before transition to the following position. As is seen, all of the advanced level cello students followed a strategy that gives priority to musicality when determining positions and finger numbers, and ensures that they are kept in memory without being written.

4.2.1.2. Legato Writing Strategies

This category is aimed at revealing what kind of strategies are developed in creating the legatos used. Intermediate level students are

divided into two sub-groups, including students who do not pay attention to legatos and students who develop strategies on the subject. Regarding the subject, G4 reported: "I try to write a piece with a time signature of 4/4 in 2/2 time in legato style. I write legatos thinking that 'there are triplets, so it would sound better if this was arranged in that particular way". With this statement, G4 indicated that she determined legatos by taking *usul*s or rhythms as basis. On the same subject, G6 stated as follows: "When practicing a piece, I can pay attention to legatos if there are legatos written on the notes. But if legatos are written after I finished practicing a piece, I cannot do the legatos. Although I think that I must write legatos first in order to learn the piece, I first write the finger numbers when I am given a musical piece". G6's finding that she can be successful playing the piece if she writes the legatos earlier is noteworthy. On basis of the opinion that it is hard to break habits, G6 mentioned that reinforcement by playing legatos and finger numbers determined at the beginning is feasible for her. This finding serves as a suggestion for prioritization of writing legatos, which is always postponed by beginner level cello students.

As an advanced level student, G7 stated: "I play with my own style when I'm on my own. But I have been joining choirs more often lately, so I usually try using legatos which vary depending on the *usul* and have become a classic. I try to play with the legatos used by violins at choirs". The statements of G7 can be interpreted to mean that she does not much consider legatos important or she fails to rationalize creating those legatos. On this subject, G8 reported as follows:

"I try playing legatos or staccato or use detaché technique in some parts. Instead of slurring over a motif, I prefer playing it bar by bar, enjoying every part of it. I try to tie notes according to the rhythm. I usually try to start and end the movement by bow pull. If the movement isn't suitable for this movement and the piece requires a different stroke technique or has a different time signature, I start the accented stroke by bow pull. For curcuna *usul* with a time signature of 10/8, I play the beats as 3 pulls, 2 pushes, 2 pulls and 3 pushes. I start again with a bow pull at the beginning of the bar. There are certain classical patterns which I instantly remember as soon as I see the piece. There may be exceptions, as well. In such cases, I pay attention to use a bow pull for the accented stroke.

Regarding the point addressed, G8 was observed to determine the legatos according to the *usul*. He uses certain legatos for certain *usul*s, and applies bow pull for the accented stroke in other exceptional cases. As stated by G8, the strategies that have become easily memorable after numerous uses save the effort of planning over and over again how to use the legatos for each individual piece. This enables G8 to save time and

focus on other features of the piece within a shorter time. On the same subject, G9 reported as follows:

"I apply legato, detaché bow, staccato, portato techniques when playing the pieces. If I know the source, history and identity of the piece I can write suitable legatos for that piece at that moment. But it is actually more appropriate to write the legatos after listening to the piece and understanding what kind of a melodic pattern it requires. A legato style which I fancy today may sound unappealing to me tomorrow. Therefore, I may have to change the legatos even when I start creating the nuances at the performance phase."

G9, like the other students at the same level as him, indicated that he determines legatos not according to the *usul* but writes them at that moment according to how the piece sounds and what features it has. However, G9 reported that factors like tastes of individuals changing over time are influential in determining the legatos, which is interesting both in musical terms and in terms of changing tastes. The given statements clearly manifest how diverse criteria are taken into consideration for writing legatos in cello performance in Turkish Music.

4.2.2. Strategies Related to Musical Performance Ability

It was revealed that all of the participants pay attention to the notion of 'musical performance ability'; however, the strategies on this subject are most commonly developed by intermediate and advanced level students. Regarding the subject, G1 stated as follows: "I think that a good performance of Turkish Music requires listening, a good knowledge of *maqam*s, imitating and the ability to reflect the feeling of the piece. I start practicing with my favorite pieces. I can't play the others beautifully because I see them merely as tasks and cannot feel them". With her foregoing statement, G1 puts forward a different point of view, noting that musical performance ability is closely related to the personal interest in the musical piece to be performed. Whereas, G3 stated: "Currently I'm not doing anything to play with better musicality", which points out to the fact that he considers intonation of the highest importance, and legatos of the lowest importance for musicality.

With regard to 'musicality', G4 expressed her own personal sense of musicality by stating that she pays attention to the ability to reflect the *maqam*s properly, not to nuances. Whereas, G5 reported: "When performing the pieces, I concentrate on how I can reflect the feeling of the *maqam*s and how I can increase the intensity of that feeling after I have fully gained the ability to perform Turkish Music pitches with correct intonation and in the correct *usul*. I do these by listening and repeating." On the same subject, G6 stated: "If, for example, there is a *maqam geçki* in a certain section, I try to give the exact sound and feeling for that specific

section by changing either the finger number or the position or trying other different things. Apart from these methods, I watch the performers whose cello performance I trust". From this statement, it is understood that G6 keeps changing the strategies until she achieves her aim.

On the same subject, G7 stated that she prefers closed positions, listens to the related genre a lot, and accompany other instruments in order to play with musicality. G8 stated: "Memorizing a piece is quite useful in the sense that the performance will not be dependent merely on the notes, and better performance can be ensured with precise accents and frequency ranges. Also, listening and hearing your own performance are highly important to play the accents accurately.". This statement points out to the significance of memorizing and listening. G9, on the other hand, approaches musicality from a different perspective, stating:

"Once I have started deciphering the piece, I think over a number of questions such as 'In which register should I play the piece? Between G bow and D bow, or only G bow? How would it be possible to play that part correctly? Is a muffled tone more effective for the feeling of the piece? Does a powerful performance or a clearer manifestation of that specific part of the piece require staccato or legato? I think over all these criteria when I start deciphering. However, what is more important is reflecting local and periodical characteristics when playing. For this purpose, the performer needs to know the local characteristics well and apply them on the instrument. I especially follow the artists who pay attention to these criteria in their performance. When performing a folk song, the enthusiasm of local performers and the mood of the song shape my decisions on whether to choose a legato or martele bowing technique. If the piece is lively or it has strong accents, I may prefer to use detaché technique rather than using too much legato. The performance is influenced by a number of factors such as having a live recording of the piece, making conversations with the local people performing the piece and hearing the story and learning the lyrics of the song. For example, if I know the story of a folk song, I can really feel its emotion or the tragic atmosphere while playing it.

With this statement, G9 addressed both the technical strategies he uses for musicality and the social factors which he thinks influence the sound. G9 indicated that his performance is shaped by how local characteristics influence his feelings, which emphasizes the fact that musicality is not so much technical or mathematical and every individual performer has their own unique style.

4.2.3. Time Saving Strategies

Time saving strategies are evaluated by the interviewed students with different perspectives and in different forms. For example, G1 stated: "When I want to play a specific piece, I listen to that piece in order to memorize it. I can play a piece within a shorter time after listening to that piece." The majority of the students perceive the notion of 'time saving' as 'gaining the ability to play a piece in the shortest time', while G2 perceived it as 'saving the time spent playing the cello'. G2 reported as follows: "Cello is my life. I don't save time when playing the cello, saving any moment is bad for me". This statement of G2 is remarkable in the aspect that it brings a different perspective to the subject.

Regarding the time saving strategies, G4 stated: "I think over not only the positions and legatos but also how to play them better. Actually, I try to do lots of things at the same time. In order to outline the piece in a short period of time, I try to contemplate and apply what I need to do and take into account at the same time." G5 and G6 also made similar statements.

While, G9 who is an advanced level cello student, reported: "As soon as I get the copy of the piece, I perform a quick sight reading and I try to figure out the difficult rhythms before starting to play the piece. Or I try to find similar rhythms and sentences in the piece from the moment I get the sheet from the library until I get to the practice room. I continue practicing the piece without playing the similar sections". In addition to the foregoing statements, the majority of the participants stated that they do not place their instruments in the case so that they save time and play their instrument more often with less breaks.

5. Conclusion

The strategies to mitigate the encountered challenges under this study are examined in a number of categories as strategies to mitigate the challenges in certain parts, strategies to correct intonation mistakes, strategies to correct rhythm - *usul* mistakes and strategies to overcome technical difficulties. As for challenges in certain parts of musical pieces, it is thought provoking that all of the beginner level students reported the difficulties they experience in terms of musicality and indicated that they do not pay much effort to overcome such difficulties although they were rather supposed to point out to technical difficulties. Even though they are able to develop strategies as to what they need to do, they cannot put such strategies into practice, which raises question marks in minds. The fact that the beginner level students interviewed are not motivated to overcome the technical difficulties and they have yet to figure out that good musical performance is related to mastering the right technique has resulted in their inability to implement strategies, if any, developed by them for good performance and, a consequent failure in achieving the expected level of

performance. It is observed that a large number of diverse strategies are used by intermediate level cello students to overcome the difficulties they experience, which reveals that this group of students think and act in the most strategic way. Intermediate level cello students usually have problems with open positions, certain *usul*s and rhythms, correct intonation, nuances and agility. With the aim to overcome their problems, this group of students refer to a number of ways, including practicing section by section, practicing at a slow tempo, practicing solfege, repetition, practicing with a metronome, avoiding open positions, taking breaks, influencing their mental state by the thought that they will be able to overcome those problems, intensely practicing on the problematic part and repeating that part after correcting it, noting down the problematic part, making mental repetitions, trying to find the same note on high and low pitches, practicing chords, listening, practicing the difficult part on the positions which they feel they have more control on, focusing on practicing other parts to forget the challenging part and then turning back to that challenging part. As it is seen, it was revealed that intermediate level students develop strategies not only in technical terms but also in terms of musicality and motivation. It was found out that advanced level cello students have difficulties with thumb positions, deciphering pieces in *maqam*s that they are unfamiliar with, and certain transpositions of Hüzzam *maqam*. In order to overcome those problems, they refer to methods such as making repetitions, memorizing and practicing section by section, as well as trying different bowing styles, different finger numbers, different motifs and rhythms. It is noteworthy that advanced level students report a number of technical difficulties rather than musical challenges. On basis of the foregoing, it can be said that the strategies developed for musical performance by advanced level students, who develop a large number of strategies for that purpose, help them achieve successful results in terms of musicality.

As for the correction of intonation mistakes, beginner level students often fail to notice if they have achieved the correct intonation while intermediate level students occasionally fail to notice the same. In order to make sure that they find the correct intonation, they refer to a number of methods such as listening to other records, repeating playing the piece from the beginning, recording their performance, checking the notes on the closed positions by comparing them to the same notes on the open position, and using a tuner. When the students notice that they have failed to achieve the correct intonation, they try methods such as repeating playing the piece from the beginning, finding the correct intonation by ear, and playing chords. On the other hand, it was revealed that advanced level cello students do not encounter too much intonation problems.

As for the correction of rhythm- *usul* mistakes, all of the beginner and intermediate level cello students were revealed to experience problems while very few advanced level students experience the same problems. Beginner level cello students reported that, as for the problems they experience with rhythms and *usul*s, they try to solve such problems by asking their instructor, listening and imitating. Intermediate level cello students stated that they try to overcome the problems they experience with Turkish Music *usul*s and rhythms by referring to a number of methods such as practicing solfege, practicing *usul*s, repetition, recording their own performance, listening to other performances and accompanying. Advanced level students reported that they usually do not experience problems with *usul*s and rhythms.

The highest number of opinions on the problems with the cello technique are stated by intermediate level students. It was understood that beginner and intermediate level cello students always check their own posture - hold. In order to correct their posture - hold, beginner level students refer to a number of methods such as practicing in front of a mirror and doing finger exercises, while intermediate level students try practicing in front of a mirror and watching performances of professional cellists. Advanced level students have incorrect posture - hold usually when the piece requires agility or they have difficulty. These students reported that they do not have difficulty with noticing or correcting their posture - hold and they do not implement any special strategy on this subject, and that they just need to remember their past knowledge of how they can correct their posture - hold. It was found out that intermediate level students follow the strategies of 'practicing etudes' and 'thinking over' in order to solve their technical problems; while intermediate level cello students do not experience much problem in technical terms.

Advanced performance strategies are categorized under three themes in frame of this study, which are: 'strategies related to the factors determined by the performer', 'strategies related to musical performance ability' and 'time saving strategies'. Whereas, the category of 'factors determined by the performer' under this study is examined under two sub-categories as 'writing finger numbers' and 'writing legatos'. Beginner level students reported that positions, finger numbers and legatos they will use are determined by their instructors and thus the students themselves could not develop a strategy on the subject. Intermediate level cello students are usually seen to follow the trial and error method until they find the correct finger numbers. They usually take the principles of 'easiness' and 'minimum movement' as basis to conclude that the finger numbers determined are correct. Advanced level cello students, on the other hand, followed a strategy that gives priority to musicality when determining positions and finger numbers, and ensures that they are 'kept in memory

without being written on the note'. Although each of the students consider different criteria important in terms of musicality, the most commonly stated opinions point out to playing legatos and avoiding open strings for playing the notes.

Intermediate level students are divided into two sub-groups, including students who do not pay attention to legatos and students who develop strategies on the subject. Intermediate level students using strategies on this subject stated that they determine legatos according to *usul*s or rhythms. Some of the advanced level students develop particular legato styles according to the *usul*, apply bow pull for the accented stroke, take the legatos of violins as basis in order to play in harmony with the strings, and determine legatos according to musical movements and how the piece sounds. All of the mentioned strategies are remarkable in the sense that they emphasize how diverse criteria are taken into consideration for writing legatos in cello performance in Turkish Music. Considering the fact that there is such a variety of legato styles used in performance of the same musical piece on the same instrument, it can be said that one of the factors creating the diversity in individual cello performance characteristics in Turkish Music is 'legato styles'.

Opinions on the strategies related to musical performance ability were most commonly stated by intermediate and advanced level students. Beginner level students mainly reported that they have not reached the required level to play with musicality, but they think that imitating, knowing the *maqam* and personal interest in the musical piece are influential in musicality. It was found out that intermediate level cello students try to play with musicality by referring to a number of methods such as listening, repeating, and determining the best positions and finger numbers to reflect the feeling of the *maqam*. Whereas, advanced level students reported that they try to achieve musicality by listening, accompanying, memorizing, playing the notes on closed positions, and choosing the register, bowing techniques and legatos depending on local and periodical characteristics.

With regard to time saving strategies, beginner level students refer to methods such as listening to performances of a particular piece, intermediate level students refer to methods such as considering technical and musical requirements together, and advanced level students refer to methods such as deciphering, mastering difficult rhythms, identifying similar rhythms and sentences and repeating them. In addition to the foregoing, the majority of the students interviewed stated that they do not place their instruments in the case so that they save time by playing their instrument more often with less breaks.

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PRE-SCHOOL EDUCATION

THE PRE-SCHOOL TEACHERS' OPINIONS ON PEER BULLYING*

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Introduction

Bullying consists of behaviors which are in the framework of aggression. Researchers working on bullying have had different opinions about the definition of bullying. Even though bullying is within the scope of aggressiveness, there are some distinctive features. According to Olweus (1999) in order to consider a behavior as bullying, there should be a power imbalance between the parties, it should be a continuous behavior and it should be performed deliberately. Furnis (2000) considers bullying, as an act of the bullying person to purposefully hurt the other person. Arora (1996) states that bullying behavior, even if implemented only once, has a negative impact on the victimized person and has a long-term effect so it should be called bullying. The most important feature that differentiates bullying behavior from other negative behaviors is that it is intentional, repetitive and has power imbalance (Smith & Myron-Wilson, 1998; Rigby, 2003).

Looking at the research done, children who are exposed to bullying were defined as smaller, less powerful and diffident children (Smith & Monks, 2008). According to Çiftçi and Sucuoğlu (2003), when the common characteristics of children who are subjected to bullying behaviors are considered, it is found that the children who are extremely sensitive, has intense anger and skepticism, generally performing below average in team games, have weak social contact with their friends and try to stay as far away from conflict as possible, have a higher probability of being victimized. It is also known that victims are more likely to be children of overprotective families (Olweus, 2005). There are arguments that the extreme protective attitude of the mother and the father's highly critical attitude and being distant causes, especially boys, to become victims (Olweus, 2005). There are studies which indicate that ignorant attitudes of fathers increase exposure to bullying (Flouri & Buchanan, 2003).

There are many studies that examine the gender factor on bullying and there are different results from these studies. There are arguments that men are more active in bullying just as in aggression. The opinion that males

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have more bullying behaviors is indicated by the teachers and peers (Monks et al., 2011). However, from the perspective of bullying type, it has been pointed out that men are more physically bullying and girls have more verbal and indirect bullying behaviors (Byrne, 1995, Smith & Ananiadou, 2003).

There are also some psychological factors in the causes of bullying behaviors. The adverse effects of bullying behaviors on children, who are either exercising or victims or are onlookers, are becoming a more and more prominent subject. The bullying children are found to have; depression, insomnia, headache and abdominal pain. It has been observed that they experience emotional behavior problems, their school achievements are low and they wouldn't be successful in business life in the following years as well (Carney & Merrell, 2001). It has been observed that in the short term, the victimized children do not want to go to school and they are alienated from school (Pişkin, 2003). Moreover, 90% of children, who are victimized, demonstrate academic failure (Hazler et al., 1992). At the same time, it was reported that 22% of the victims had physical illness complaints and 20% had sleep problems (Sharp, 1995). It was found that children victimized by bullying behaviors experience more emotional problems (sadness, unhappiness, anxiety, fear, depression, posttraumatic stress disorder) than children who exercise bullying and the onlookers of bullying behaviors (Alikaşifoğlu & Ercan, 2007).

The teachers have a major task in applying effective intervention methods to peer bullying which has started to increase even in preschool period and has such adverse effects. There are very few studies which study prospective teachers' beliefs and attitudes on peer bullying (Craig et al., 2000). Another study reported that prospective teachers do not know much about what is peer bullying, how to prevent it and how to intervene and also that they have not been taught methods on how to cope with negative behavior. (Kandakai & King, 2002). Yoon and Kerber (2003) reported that teachers were not able to plan effective intervention methods when they could not fully define bullying, according to their study where they developed various bullying scenarios to research teachers' intervention methods.

Although there are studies researching bullying behavior in elementary school and adolescence periods, there are very few studies that include the pre-school period (Perren, 2000). When bullying behavior studies involving preschool are examined, it is determined that bullying behavior rates in the first three years of elementary school are very close to those seen in preschoolers (Alkaser et al., 2010). This result indicates that it is necessary to carry out studies on children in the pre-school period (Aslan, 2013). So when the development of peer bullying is researched, it appears

that it starts at the beginning of establishing relationships with peers during preschool and continues in the following years (Hanish et al., 2005). It is known that being bullied during preschool creates psychological problems in the future life of the child and is the basis of adjustment problems (Ladd, 1990). Bullying behavior in preschool; is a very important issue because it has long-term developmental outcomes influencing children and not just on the ones exposed to it but also on those who implement those behaviors. Negative situations experienced in this period affect the child's whole life adversely and cause him to become weaker in terms of social-emotional aspects (Uysal & Dinçer, 2012).

Method

This is a qualitative study in which interview technique is used to determine teacher opinions about peer bullying in the preschool period. The sample of this study consists of 3 preschools and 14 teachers located in Mersin province, for the academic year of 2016-2017. The schools included in the study are chosen from high, medium, and low socioeconomic levels to create a maximum range of variety for the sample group. The data were collected by preparing semi-structured interview questions prepared by the researcher. The interview form is designed to determine the preschool teachers' definition of peer bullying and its characteristics. Interviews took place between February and March 2017 on days and dates that teachers were eligible for, in the guidance services of schools or in the teachers' room, and lasted 40-45 minutes on average.

Findings

1. Findings on Teachers' Opinions for the Definition of Peer Bullying

The analysis of the answers of preschool teachers to the question *"How would you define peer bullying?*, are examined. It is seen that concepts of Repression (f = 16), Violent behavior (f = 7) and Way of Self-expression (f = 3) appear according to the frequency of repetition, under the theme of 'Definition of Peer Bullying'. In the Repression category, it is determined that pressure generally takes place in three forms such as "*pressure, psychological pressure,and physicalpressure"*. In the Violent Behavior Category, it is determined that "*violence, physical, verbal and emotional"* concepts are coming forth. Moreover, there are some participants who defined bullying as "*a way of expressing himself*".

2. Findings on Teachers' Opinions for the Types of Peer Bullying

The analysis of answers that teachers gave to the question *"What bullying behaviors do children have at school most frequently?"*, which is

designed to determine the types of peer bullying encountered in preschool period, takes place in three subcategories of physical, verbal and emotional and their relevant codes. When the teachers' opinions are analyzed according to frequency, they are grouped as Physical bullying (f = 44), Verbal bullying (f = 24) and Emotional bullying (f = 19). Considering the types of physical bullying, types of behavior such as *"hitting, pushing, biting, taking belongings, hair pulling, pinching, scratching his paper, slapping, crushing, blocking, tugging, hiding belongings, kicking, scratching"* have been identified. Considering the codes in verbal bullying, reactions such as*" condescending words, ridiculing, mocking, insulting words and shouting*" take place. In emotional bullying category, reactions such as *"sulking, exclusion, excluding from the game, leaving alone, not sharing, ignoring, not showing respect, spoiling the game, rigging the game* " are drawing attention.

3. Findings on the Influence of Gender Factor in Peer Bullying

The analysis of answers that teachers gave to the question *"How much is gender factor influential according to you, in bullying behavior experienced in preschool period?"*, which is designed to determine the influence of gender on bullying behavior in preschool period. Within the framework of the Gender Category, it is determined that girls and boys demonstrate different types of bullying, boys bully more than girls and that this situation stems from the influence of the family. It is determined as Boys (f = 18), Girls (f = 12) and influence of the family (f = 8), according to frequency. In the boys gender category, the concepts of *"bullying, physical bullying and the nature of men*" concepts were defined. In the girls category *"emotional bullying, the victim, good self-expression"* concepts were defined. The concepts in the family influence category were defined as *"the upbringing style of family, Turkish culture "*.

4. Teachers' Opinions for Determining the Characteristics of Bullying and Victimized

4.1. Characteristics of Bullying Children

The characteristics of bullying children are grouped as personal and family characteristics. The researcher asked the teachers, the question of *"What are* the characteristics of bullying children?" Personal characteristics (f = 40) and Familial characteristics (f = 22) subcategories were formed under the theme "Characteristics of Bullying Children". In the personal characteristics category, there are characteristics such as, "*not able to express oneself, low self-confidence, leadership spirit, feeling lack of love, low self-esteem, vigorous, jealous, watching too much TV, vicious, aggressive, distractible, impatient, selfish, curious and creative"*. Whereas, in the familial characteristics category, the situations and characteristics such as *"violent behavior in the family, low-quality time, too much spoiling,*

crowded family environment, family problems, dominant parents attitude, separated parents" are worth noting.

4.2. Characteristics of Victimized Children

The researcher asked the question, *"What are the characteristics of victimized children"* to obtain this data. Under the theme of "characteristics of victimized children", groups of Personal characteristics (f = 36) and Familial characteristics (f = 8) were formed. In the category of personal characteristics, there are *calm, introvert, low self confidence, passive, asocial, weak, low self-expression, physical impairment, sober-minded, emotional, shy"* , whereas in the Familial characteristics, there are " *oppressed at home, needy for belonging to a group, protective family, not able to prove oneself, lack of love and affection".*

5. Teachers' Opinions on Causes of Bullying Behaviors

5.1 Causes stemming from parental attitudes and behaviors

The researcher asked the question, *"What are the attitudes and behaviors of parents* to obtain this data. Under this theme, two categories were determined as Wrong attitudes (f = 54) and Familial causes (f = 18), according to the rate of frequency. Under the wrong attitude category, features such as "*Uncaring attitude, spoiling the child, the authoritarian approach, inconsistent words and behaviors, approval of bullying behaviors, impatience, not developing sense of empathy, not teaching the right & wrong, overprotective attitude, expectations above the capacity of the child"* are attracting attention. While in the familial causes category, there are features such as "*Domestic violence, father's domination, communication problems, single parenting, polygynist father, crowded family environment, inconsistency among parents".*

5.2. Causes stemming from the caregiving people

The opinions of teachers take place when answering the question, "*What is the role of caregivers when children show bullying behaviors?"* to measure the effect of caregivers on bullying behaviors. The theme of "Causes stemming from caregivers" was formed and under this theme "Maternal grandmother or paternal grandmother (f = 12)" and "Babysitter (f = 12)" categories were formed with equal frequency rates.

5.3. Causes stemming from media

The researcher asked the question "*What is the effect of the media on the bullying?"*to obtain this data. Under this theme, "Impact on the child (f=35)" category was determined. The generated codes are "*blending reality with fiction, developing different value judgments, heroic role*

impersonation, developing lack of self confidence, developing mental problems, role modeling, will to gain power, social isolation, communication inability, latent learning, requesting that he sees in ads, emotional blunting, difficulty in self-expression".

Discussion

When we consider the data obtained from the teachers for the definition of bullying, it was determined that a large majority considers bullying as a repressive practice and divides into two as physical and psychological. The powerfulness characteristic of the person applying the pressure was especially emphasized. The strong emphasis on powerfulness, while peer bullying was defined, is compatible with the opinions of the teachers in this respect. On the other hand, some of the teachers, when defining bullying, emphasized the phenomenon of violence and interpreted bullying as demonstrating a physical, verbal and emotional violence. When the studies were examined, it was noted that while the violence, aggression and bullying are associated with each other, there are differences in their definitions. Violence is a type of aggression which incorporates negative feelings such as anger, grudge, resentment and hatred, in itself (Köknel, 2000). Considering this perspective, it was noted that some teachers confuse bullying behaviors and the concept of violence and thus contradict with the definition of bullying. Finally, a small number of teachers interpreted bullying in the preschool period as actually a child's way of self-expression.

The child in preschool period is in an effort of developing relations with his peers and gaining experience on how to express his personal requests better in a social environment (Bradley, 2001; Green et al., 2008). When assessed overall, the teachers' opinions about the definition of bullying are directly compatible with the literature. But when it comes to the preschool period and when the developmental characteristics of this age group are taken into consideration, it can be claimed that the idea of considering it as way of self-expression or a way of expressing their feelings, thoughts, and wishes since the children's communication abilities are not yet developed, can be more dominant.

When the types of bullying-related studies were examined, the physical bullying behaviors in preschool period are determined as hitting, slapping, pinching, hair pulling like actions, while verbal bullying behavior are determined as using condescending words, ridiculing, mocking and using insulting words (Uysal, 2011; Olweus, 2005; Espelage & Swearer, 2003). These findings; are compatible with the opinions of the teachers participating in this study. Eliot (1997) stated that behaviors he considered as emotional bullying are not-speaking, exclusion, leaving alone, exclusion from the group. The opinions of the teachers in this study are also

consistent with this grouping. In this study, it was prominent that as the children grow older their behaviors of emotional bullying also increased. Teachers opined that children demonstrate more physical bullying around the age of three. But as they grow older and start to complete their emotional development, they start learning some strategies and start performing psychological bullying.

When studies of gender impact on bullying were examined, it was reported that boys demonstrated more bullying behaviors than girls and also they demonstrated physical bullying behaviors more than other bullying types (Pellegrini, 1998; Craig et al., 2003). Considering these results, the opinions of teachers participating in this study can be claimed to be compatible. In this part of the research on the influence of the gender factor, teachers point out that Turkish culture, customs and traditions, as well as families' attitudes in upbringing children, are the main reasons why boys demonstrate bullying behaviors more dominantly and explicitly.

Teachers state that the most prominent personal characteristic of bullying children is that they have difficulty in expressing themselves. This opinion is notable and specifically emphasized in defining the preschool peer bullying concept. This result leads us to think that the child, whose age is between 3 and 6, feels inadequate in expressing himself and refers to bullying behaviors to explain himself when he cannot achieve it otherwise. This case points to the contrary of the idea that "the purpose of harming the other person" which is in the definition of peer bullying. It is argued that children who are in pre-school age changeover from physical bullying to verbal bullying parallel to their language development and moreover they develop more compromising solutions in response to problems as language development of the child increases (Ladd et al., 1997). This data seems to support the findings of the research we have done. The second characteristic of children demonstrating bullying behavior is their lack of self-confidence. Teachers argue that it may due to the fact that children lack sufficient love and care. It can be claimed that children try to resolve this inadequacy of feelings through bullying behavior and gaining power. Uysal and Dinçer (2012) stated that bully children continue to demonstrate these behaviors because it makes them feel stronger when their behaviors exulcerate the victims. The next most important characteristic of bullying children is their having leadership spirit. If we make an assessment according to the theory of mind, bully children are psychologically more powerful than children who do not demonstrate bullying behaviors (Juvonen et al., 2003), because the bullying child is very good at calculating the situations that will benefit him when exhibiting these behaviors. They have an aim of proving how strong they are by targeting children with fewer friends (Pellegrini & Long, 2004).

When we assess the teachers' opinions, it is found that children who are victims have a very quiet, calm, introvert personality. A reason for their low self-confidence can be shown their lack of competence to defend themselves. Victimized children cannot defend themselves when they are confronted with children who bully them (Gökler, 2009; Hawkins et al., 2001).

There aren't many studies carried out on the influence of caregivers for the causes of bullying. Although children begin to learn the social competencies from their interaction with their parents and people in the caregiver status, siblings, friends, and other grownups are included in this interaction afterward and that's the way social competence of children are attained (Cartledge & Milburn, 1980:51).

When the impact of media on bullying behaviors is considered according to the thoughts of teachers, spending too much time on TV, tablet or in front of the computer and watching cartoons, news, ads, etc which are not in accordance with their age and developmental period cause them to form wrong patterns. Children are exposed to too many negative environmental stimuli in everyday life. Harmful habits such as auditory, visual media, tablets and computer games cause some problems in children's feelings and behaviors (Sapsağlam, 2015)

Conclusion

According to the preschool teachers

1. Peer Bullying: is a way of repression, a violent act, and self-expression.

2. Types of Violence: are grouped in three categories such as Physical, verbal and emotional.

3. The gender factor: Boys demonstrate more bullying behavior, and mostly physical bullying, while girls mostly demonstrate emotional bullying behavior. The Turkish culture and family's style of upbringing are influential in these differences.

4. a) Characteristics of bullying children: It is stated that factors such as, unable to express himself, lack of self-confidence, leadership spirit, lack of love, low self-esteem, violent behavior in the family, low-quality time, too much spoiled, crowded family environment, family problems, the dominant parents attitude and separation of parents are influential.

b) Characteristics of victimized children: It was stated that they are calm, introvert, has lack of confidence, passive, asocial, powerless, has low self-expression, repressed at home, who feel the need to belong to a group, from overprotective family, unable to prove himself and doesn't get love and care.

5. Causes of bullying behavior

a) Causes attributable to parental attitudes and behaviors: are considered as spoiling the child, inconsistent words and behaviors, ignoring the child's feelings, violence to the child, approval of bullying behaviors, impatience, insufficient reward, insufficient love, and care.

b) Causes attributable to caregiving people: were expressed as inconsistent rules, flexible rules, spoiling the child, over possessing the child, emotional inadequacy, lack of care and love, emotional incompetence, mirroring the problems on the child, not applying the rules and low educational level.

c) Media-induced causes: come forth as blending reality with fiction, developing different value judgments, hero role impersonation, lack of self-confidence, impairment of mental health, role modeling, will to gain power, social isolation and communication inabilities.

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BASIC EDUCATION

BEWERTUNG UND BEURTEILUNG VON LEHRKRÄFTEN

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Einleitung

Ein wichtiger Bestandteil der Lehrerausbildung ist neben dem Unterrichten, Erziehen, Innovieren und Beraten auch das Beurteilen. Beurteilungen und Bewertungen sind sowohl im Rahmen von mündlichen und schriftlichen Leistungsüberprüfungen, bei der Feststellung von Lern- und Arbeitsstörungen erforderlich, als auch bei der Unterrichtsplanung und -gestaltung, wenn es darum geht, die Fähigkeiten der Schülerinnen und Schüler und die unterrichtlichen Anforderungen aufeinander abzustimmen, um eine möglichst optimale Lernumgebung zu gestalten (Helmke, Hosenfeld & Schrader, 2004; Schrader, 2011).

Diese Herausforderung, das Bewerten und Beurteilen von Schüler/-innenleistungen, gehört zweifelsohne zur stetigen Berufspraxis von Lehrkräften aller Schulformen, -stufen und Unterrichtsfächer. Auffassungen aus der Literatur (vgl. Jentzsch, 1993, S. 385) sowie die Einschätzung vieler Lehrkräfte selbst (vgl. Lehnen, 2008, S. 94), Beurteilen und Bewerten werde nicht in der Universität sondern im Berufsalltag gelernt, lassen vermuten, dass der Bereich Bewerten und Beurteilen in der universitären Lehramtsausbildung indessen bisher kaum systematisch verankert ist. Im Zuge der Kompetenzorientierung von Lehrkräften gewinnt die Beurteilungstätigkeit allerdings vermehrt an Bedeutung,

In der Literatur wurden vielfach Bewerten und Beurteilen begrifflich ausdifferenziert (z.B. Fritzsche, 1994; Müller-Michaels, 1993; Böttcher/Becker-Mrotzek, 2007) und die Funktionen einer Beurteilung (z.B. Sacher, 2001) dargestellt. Zahlreiche Veröffentlichungen gibt es zu Beurteilungen im Kontext spezifischer Unterrichtsformen (z.B. im offenen Unterricht (Bohl, 2009)), Schulstufen und -formen (z.B. in der Grundschule (Böttcher/ Brosch/Schneider-Petri, 1999)) und Fächern.

Was es nun braucht um den Anforderungen des Beurteilens und Bewertens gerecht zu werden, welche Voraussetzungen für ein angemessenes Beurteilen erfüllt sein müssen, werden in diesem Beitrag dargestellt. Zunächst wird kurz die begrifflichen Grundlagen Bewerten und Beurteilen geklärt Im nächsten Schritt werden aus theoretischer und Forschungssicht auf die Struktur, die Konstruktmerkmale sowie auf generell mit (Lehrer-)Urteilen im Zusammenhang stehende Faktoren

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beschrieben. Am Ende wird für die Verbesserung von Bewerten und Beurteilen eingegangen.

2. Begriffsklärungen: Bewerten und Beurteilen

Im (fach-)didaktischen Kontext haben sich zwei Definitionen etabliert, die in ihrer Unterscheidung für den Schulalltag möglicherweise nicht ergiebig erscheinen, sehr wohl aber für die theoretische Annäherung an den Gegenstand. Nach Becker- Mrotzek und Böttcher (2006) ist *bewerten* „ein kognitiver Akt bzw. mentaler Prozess des Einschätzens (...). Dem Bewerten liegt (...) ein Wertmaßstab zugrunde, der sich in Form von Kriterien beschreiben lässt. (...) Jeder Bewertungsvorgang ist (...) immer mit Verstehensbemühungen verbunden (...).“(Becker-Mrotzek/Böttcher, 2006, S. 88).

Dahingegen verstehen sie unter *beurteilen* „eine verbal geäußerte Bewertung, die (...) gegenüber dem Schüler/Schreiber geäußert wird. Der bewertete Schülertext (...) wird auf Normen, Kriterien und Wertmaßstäbe bezogen.“(ebd.).

So definiert, wird eine Bewertung als eine auslegende, hermeneutischinterpretatorische Tätigkeit und eine Beurteilung als eine im didaktischen Zusammenhang verbal geäußerte Bewertung in Lern und Leistungssituationen verstanden. Diesem Verständnis zufolge liegt jeder Beurteilung immer eine Bewertung zugrunde. *Benoten*, als nächster Schritt, sei die die zusammenfassende Bewertung einer Leistung in Form einer Ziffernnote (Becker-Mrotzeck/Böttcher, 2006, S. 88).

Die Begriffsdifferenzierung von Becker- Mrtozek und Böttcher schließt sich Müller-Michaels an, der schon 1993 konstatierte: „Entsprechend der (…) Terminologie wird unter Bewertung die auf ein Werturteil gerichtete Durchsicht von Schülerarbeiten, unter Beurteilung der verbal geäußerte Bewertung und unter Benotung die zusammenfassende Wertung durch eine Ziffernnote verstanden.“ (Müller-Michaels, 1993, S. 348).

Wenn *bewerten* bedeutet, sich sein Urteil zu bilden, meint *beurteilen,* dieses Urteil zu kommunizieren. Beurteilen ist also grundsätzlich ein kommunikativer Akt, der je nach Situation mündliche (im Gespräch) oder schriftliche Kompetenzen (bei einem Lehrerkommentar z.B.) benötigt. Die Literatur und Forschung erschloss bis jetzt allerdings vorrangig das schriftliche Beurteilen (traditionell zur Aufsatzkorrektur, aber auch neuere Veröffentlichungen (z.B. Jost/Lehnen/Rezat/Schindler 2011))– daher bezieht sich eine mögliche Beurteilungskompetenz in dieser Arbeit vorwiegend auf dieses. Eine „verbale“ Beurteilung ist im Folgenden im eigentlichen Wortsinn „mit Hilfe der Sprache“ zu verstehen und nicht unweigerlich mit „mündlich“ gleichzusetzen.

3. Theoretische Grundlagen des pädagogischen Bewertens und Beurteilens von Lehrpersonen

Für Lehrerbewertungen gelten Kriterien, an denen sich die Qualität ablesen lässt. Die wichtigsten Gütekriterien des bewertens sowie Beurteilens sind Objektivität, Zuverlässigkeit (Reliabilität) und Gültigkeit (Validität)

Von Objektivität wird dann gesprochen, wenn Bewertungen möglichst unabhängig vom Urteilenden sind. Im schulischen Kontext bedeutet dies, inwieweit verschiedene Lehrer in ihren Bewertungen über den gleichen Sachverhalt übereinstimmen. Lehrerbewertungen sind entsprechend dann objektiv, „wenn intersubjektive Einflüsse der Untersucher möglichst ausgeschaltet werden können“ (Ingenkamp, 2005). Um dies zu erreichen, müssten möglichst viele übereinstimmende Arbeitsschritte im Beurteilungsvorgang festgelegt werden, was gemeinhin mit der Unterscheidung in Durchführungs-, Auswertungs- und Interpretationsobjektivität versucht wird.

- Durchführungsobjektivität: Objektivität in der Durchführung versucht man dadurch zu erreichen, dass für alle Lernenden die gleichen Anforderungen unter gleichen Bedingungen gelten. Dazu trägt eine möglichst große Vereinheitlichung von allen durch die Lehrer beeinflussbaren Faktoren wie die Aufgabenstellung, die Bearbeitungszeit, Erläuterungen etc. bei. Völlige Gleichheit der Bedingungen ist hingegen nicht zu erwarten, da eine Reihe von Faktoren im Schüler selbst liegt, beispielsweise sein Wohlbefinden, seine Motivation oder seine Leistungsangst. Wird bei standardisierten Testverfahren in der Regel der Ablauf detailliert von der Instruktion bis zur Zeitvorgabe festgelegt, ist dies bei alltäglichen Leistungsbeurteilungen nicht der Fall, da es keine allgemein verbindlichen Vorgaben gibt und jeder Lehrer selbst darüber entscheidet.

- Auswertungsobjektivität: Wie wiederholt gezeigt werden konnte, werden identische Schülerleistungen von verschiedenen Lehrern durchaus unterschiedlich beurteilt (vgl. Ingenkamp, 1995b). Das offensichtliche Fehlen objektiver Kriterien, nach denen Leistungen bewertet werden sollen, führt zu mangelnder Auswertungsobjektivität. Deutlich verbessern ließe sie sich zum Beispiel durch Aufgabenstellungen, zu denen eine Falschlösung zweifelsfrei von einer Richtiglösung unterschieden werden kann, wie es zum Beispiel bei Multiple-Choice-Fragen der Fall ist.

- Interpretationsobjektivität: Je zahlreicher und je unterschiedlicher die zur Verfügung stehenden Informationen sind, die bei der Beurteilung einer Leistung zur Verfügung stehen, desto schwerer fällt eine objektive Interpretation unter Ausschaltung aller intersubjektiven Einflüsse. Leiten

verschiedene Lehrer aus einer Leistung die gleichen Schlussfolgerungen ab, so kann Interpretationsobjektivität angenommen werden (Tent & Stelzl, 1993). Im schulischen Kontext könnte dies beispielsweise die Zuordnung von verschiedenen Punktwerten in einer Leistungsüberprüfung zu Notenstufen sein.

Die Objektivität von Beurteilungen ist die entscheidende Voraussetzung für die anderen Gütekriterien. Ohne Objektivität können Messungen oder Einschätzungen auch nicht zuverlässig und gültig sein.

Die Reliabilität (oder Zuverlässigkeit) von Messungen bezeichnet den Grad der Sicherheit oder Genauigkeit, mit dem ein Merkmal gemessen werden kann (vgl. Ingenkamp, 2005). Zuverlässig bedeutet insbesondere, dass dieselbe Leistung nach einiger Zeit immer noch genauso beurteilt wird wie beim ersten Mal. Legt man Lehrern mit zeitlichem Abstand denselben Aufsatz zweimal zur Bewertung vor, kann die Reliabilität der Beurteilung sehr genau gemessen werden. Im Idealfall würde er beide Male zur selben Einschätzung gelangen. Bei anderen Merkmalen wie beispielsweise der stark tagesformabhängigen Motivation der Schüler kann nicht erwartet werden, dass die Zuverlässigkeit von mehrfachen Einschätzungen sehr hoch ausfällt, denn die Reliabilität kann nicht höher sein als die Stabilität des einzuschätzenden Merkmals. Der Grad der Reliabilität und somit das Ausmaß, in dem eine Messung reproduzierbar ist, kann durch einen Reliabilitätskoeffizienten angegeben werden (z.B. Lienert & Raatz, 1998, S. 9). Bei Aussagen zur Zuverlässigkeit wird immer davon ausgegangen, dass jedes Messergebnis einen wahren und einen verfälschenden Anteil enthält. Um das Verhältnis dieser Anteile zu schätzen, sind verschiedene Methoden verfügbar, deren gebräuchlichste die Wiederholungs- (Retest), die Halbierungs- (Split-Half) und die Paralleltestmethode sind.

- Wiederholungsmethode: Hierbei bearbeitet dieselbe Person dieselbe Aufgabe zu verschiedenen Zeitpunkten. Lehrer könnten sich selbst überprüfen, indem sie dieselben Schülerarbeiten mit zeitlichem Abstand doppelt beurteilen. Nicht außer Acht zu lassen sind hierbei natürlich Lern- oder Übungseffekte, die umso stärker zu Tage treten, je kürzer der Abstand zwischen den Zeitpunkten ist.

- Halbierungsmethode: Bei dieser Methode wird die Anzahl der zu beurteilenden Aufgaben in zwei Hälften geteilt, zum Beispiel durch die Auswahl jeder zweiten Aufgabe. Indem jede der Hälften getrennt beurteilt oder ausgewertet wird, kann durch anschließenden Vergleich der zwei Hälften die Halbierungszuverlässigkeit bestimmt werden. Bei zufälliger oder unsystematischer Zuweisung der Aufgaben zu den Hälften sollten zwischen ihnen keine großen Unterschiede bestehen. Auch dieses Verfahren könnten sich Lehrer zu Nutze machen, indem sie zum Beispiel

erst eine Hälfte einer Klassenarbeit bei allen Schülern korrigieren und anschließend die andere Hälfte. Auch andere Vorgehensweisen sind denkbar.

- Paralleltestmethode: Um im Sinne eines Paralleltests zu bewerten, müssten zwei nahezu identische Leistungstests eingesetzt und bewertet werden. Die Urteile sollten dann nicht voneinander abweichen.

Alle Methoden der Reliabilitätsbestimmung zielen darauf ab, dass vom Grad der Übereinstimmung auf die Zuverlässigkeit der Messung oder Beurteilung geschlossen werden kann (Sacher, 2009).

Die Validität (oder Gültigkeit) eines Verfahrens, die Auskunft darüber gibt, ob tatsächlich das gemessen wurde, was zu messen beabsichtigt war, gilt als das wichtigste methodische Kriterium für Untersuchungsverfahren (Ingenkamp, 2005) und setzt ihrerseits hohe Objektivität und Reliabilität voraus (Jäger, 2000; Lienert & Raatz, 1998).

Es gibt im Schulumfeld mannigfaltige Situationen, in denen die Frage nach der Validität relevant wird, bei spielsweise dann, wenn sich zum Urteil über die inhaltliche Qualität eines Aufsatzes auch die Anzahl der Rechtschreibfehler gesellt. Um zu entscheiden, ob man tatsächlich das gemessen hat, was man wollte, bedarf es eines Kriteriums, von dem es wiederum verschiedene gibt.

- Inhaltsvalidität: Um Inhaltsvalidität zu gewährleisten, dürfen in Prüfungen nur solche Kompetenzen gemessen werden, die zu erwerben die Schüler im Vorfeld auch tatsächlich ausreichend Gelegenheit hatten (Jürgens, 2005). Das in der Schule immer wieder anzutreffende Abfragen von Inhalten, die im Unterricht nur am Rande behandelt wurden, verstößt beispielsweise dagegen. Die Form der Prüfung muss demzufolge der Form der Stoffvermittlung entsprechen. Eine Sonderform der Inhaltsvalidität ist die curriculare Validität, die dann gegeben ist, wenn Prüfungs- und Unterrichtsinhalte sich gleichermaßen an den Vorgaben durch den Lehrplan orientieren.

- Vorhersagevalidität: Vorhersage- oder Prognosevalidität ist dann gegeben, wenn aus Leistungsmessungen korrekte Schlüsse auf zukünftige Leistungen gezogen werden. Dies ist zum Beispiel bei Übertrittsempfehlungen am Ende der Grundschulzeit der Fall, wo die zukünftige Leistungsfähigkeit abgeschätzt werden muss. Die Überprüfung derselben stellt Lehrer allerdings vor große Herausforderungen, da - wie im genannten Beispiel - viele andere Faktoren, u.a. die veränderte schulische Umgebung, Einfluss der Mitschüler, persönliche Ereignisse - im Prinzip gar nicht oder nur sehr schlecht vorhergesehen werden können.

- Konstruktvalidität: Während sich die beiden zuletzt genannten Formen der Validität empirisch überprüfen lassen, trifft dies auf die Konstruktvalidität nicht zu. Bei ihr liegt der Schwerpunkt zunächst darauf zu klären, ob die gemessenen Eigenschaften mit dem zugrunde liegenden theoretischen Modell übereinstimmen. Die zu messenden ‚Konstrukte' (z.B. Intelligenz oder Prüfungsangst) sind hierbei nicht unmittelbar beobachtbar, sondern müssen als latente, komplexe Merkmale abgeleitet werden. Ob sie valide gemessen wurden, kann nur abgeschätzt werden, indem geprüft wird, ob sich theoretisch erwartete Beziehungen zwischen beteiligten messbaren Eigenschaften nachweisen lassen. Bei der Schülerbeurteilung ist die Konstruktvalidität dann von besonderer Bedeutung, wenn nicht direkt beobachtbare Schülereigenschaften (z.B. ihr Fachinteresse) aus anderen - beobachtbaren - Merkmalen (z.B. ihrer Aufmerksamkeit oder ihrer Mitarbeit) abgeleitet werden müssen.

So plausibel die dargestellten Gütekriterien auch im Umfeld schulischer

Leistungsbeurteilungen erscheinen, so ist vor einer zu starken Dominanz von Modellen zu warnen (vgl. Innenkamp, 2005). Hier stellt sich die Frage was Alternatif genutzt werden kann, auf das naher eingegangen wird.

3.1. Alternative Gütekriterien der Bewertung und Beurteilung

Weinert und Schrader (1986) geben an, dass es unmöglich ist, aufgrund psychometrisch gewonnener Kennwerte verschiedener Schüler (Intelligenz, Vorkenntnisse, Anstrengungsbereitschaft, Aufmerksamkeit etc.) die Leistungen in einzelnen Schulfächern hinreichend genau vorherzusagen, um daraus handlungsleitende Erwartungen, das passende Lehrerverhalten oder eine adäquate Unterrichtsgestaltung ableiten zu können. Sie schlagen daher alternative Gütekriterien vor.

- Lehrerbewertungen während des Unterrichts müssten keineswegs besonders genau sein, wenn sich die Lehrer der Vorläufigkeit und Revisionsbedürftigkeit bewusst sind. Eine ungefähre Bewertung, die dafür aber im Verlauf des Unterrichts permanent überprüft wird, sei wichtiger.

- Desweiteren sei hohe Sensitivität für Verhaltens-, Wissens- und Motivationsänderungen der Schüler und gegenüber darauf einwirkender unter richtlicher Maßnahmen bedeutsam, wobei der Schwerpunkt auf Verlaufs- und nicht auf Zustandsdiagnostik liegen sollte.

- Wichtig sei ferner die Berücksichtigung verschiedener Beurteilungsmaßstäbe, neben sozial- und kriteriumsorientiertem vor allem das individuumszentrierte Bezugssystem, für das Rheinberg (Rheinberg,

1980, 2006) einen besonders großen unterrichtspraktischen Nutzen konstatiert.

- Nicht zuletzt weisen Weinert und Schrader (1986) darauf hin, dass Lehrerbewertungen sich nicht durch (praktisch ohnehin kaum zu erreichende) neutrale Objektivität, sondern eher durch eine pädagogisch günstige Voreingenommenheit auszeichnen sollten. Hiermit spielen sie auf den Aspekt an, dass sich eine mäßige Unterschätzung von Leistungsunterschieden zwischen Schülern einer Klasse und eine leichte Überschätzung des Leistungsniveau des Einzelnen sogar günstig und motivierend auswirken kann, wohingegen besonders exakte Urteile unterrichtspraktisch und psychologisch als unrealistisch zu bezeichnen sind.

Diese alternativen Gütekriterien sind insbesondere für den unterrichtlichen Alltag bedeutsam, während sich die Forschung zur Bewertungs- und Beurteilungskompetenz eher an den klassischen Gütekriterien orientiert.

Dennoch ist zu betonen, dass seit den 70er Jahren empirische Studien (bspw. von Ingenkamp 1971) fehlende Objektivität, Reliabilität und Validität der gängigen Praxis einseitig kommunizierter Ziffernzensuren belegten und auf mangelnde Aussagekraft und unerwünschte Folgewirkungen von Noten verweisen. Dabei ist ein immanentes Problem der schulischen Leistungsbewertung Erwartungen, Voreinstellungen und Hypothesen der Lehrer, die die Wahrnehmung von Schülerleistungen beeinflusst.

Aus der Sozial- und Wahrnehmungspsychologie sind eine ganze Reihe von Effekten bekannt, die die Wahrnehmung beeinflussen. Im Folgenden werden jene Bewertungs- und Beurteilungsfehler beschrieben, die Erklärungspotential für Ursachen von ungenauen Urteilen aufweisen.

3.2. Urteilsfehler bei der Bewertung und Beurteilung

Menschen können mit ihrer begrenzten Aufnahme- und Verarbeitungskapazität tatsächlich immer nur einen kleinen Ausschnitt der Realität wahrnehmen. Dabei wird der Fokus der Wahrnehmung zusätzlich durch die jeweils individuellen Bedürfnisse, Interessen, Einstellungen, Werthaltungen oder Motive beeinflusst und gelenkt (Hofer, 1986), was im Idealfall zu einer gezielteren Beobachtung führt, in vielen Fällen aber auch zu oberflächlicher oder verzerrter Wahrnehmung.

Eines der Effekte, die die Wahrnehmung beeinflussen sind zweifelsohne Erwartungen. Erwartungseffekte entstehen dadurch, dass Lehrer an ihre Urteile mit bestimmten Erwartungen herangehen (vgl. Baurmann, 1995; Ingenkamp, 1989). Die langfristigen Auswirkungen der

Erwartungen von Lehrkräften auf die Leistungen ihrer Schüler sind intensiv untersucht worden und unter dem Begriff des Pygmalion-Effekts (vgl. Rosenthal & Jacobson, 1971) bekannt. Es heisst, „dass die Erwartungen eines Lehrers sein Unterrichtsverhalten derart beeinflussen, dass Schülerleistungen nach einiger Zeit so ausfallen, wie er es erwartet - auch dann, wenn die Lehrererwartung i.d.S. unangemessen war, als der Schüler ohne diese Lehrererwartung andere Leistungen gezeigt hätte. Damit könnten Erwartungen des Lehrers Vorhersagen sein, die die Kraft haben, sich selbst zu erfüllen“ (Rheinberg, 1980). Diese Prophezeiungen treten auf, wenn der Schüler weniger Leistet, als es nach seinen Fähigkeiten möglich wäre oder der Lehrer unterschätzte bislang die Fähigkeiten des Schülers und macht dem Schüler dies auch deutlich, und der Schüler hat diese Einschätzungen des Lehrers auch internalisiert (vgl. auch Rheinberg, Bromme, Minsel, Winteler & Weidenmann, 2001, S. 311).

Ein weiteres Effekt sind Projektionsfehler, die dann auftreten, wenn Lehrer dazu neigen, eigene Eigenschaften, Merkmale oder Wünsche auf die Schüler zu übertragen oder in ihnen wiederzufinden glauben. Projektionsfehler können erfolgen, wenn der Lehrer sich selbst als deutlich beser als den Schüler empfindet, oder er meint ihm Schüler ähnliche Eigenschaften zu sehen wie er selber besitzt (vgl. Kleber, 1992). Derart verfälschte Wahrnehmungen können sich leicht auf Leistungsbeurteilungen auswirken.

Wenn affektive Komponenten beteiligt sind, wie z.B. Sympathie oder Antipathie zwischen Lehrer und Schüler, ist vom Halo-Effekt die Rede. Darunter wird die Verzerrung von Urteilen aufgrund eines globalen Gesamteindrucks verstanden. Dabei scheint ein einzelnes Merkmal für Beobachter so bedeutsam zu sein, dass es wie ein Heiligenschein (halo) andere Personenmerkmale überstrahlt. Beispielsweise könnten im schulischen Kontext leistungsunabhängige Merkmale wie die Kleidung der Schüler, ihre Art des Auftretens, ihre Disziplin oder ihr Sprachverhalten die Leistungsbewertung beeinflussen. Insbesondere dann, wenn Leistungen zu bewerten sind, die nicht direkt zu beobachten oder nicht eindeutig definiert sind, kann somit z.B. ein unordentliches Auftreten des Schülers auch die Bewertung seiner Leistung negativ beeinflussen (Sacher, 1996).

Nicht immer eindeutig vom Halo-Effekt abzugrenzen ist der logische Fehler in der Beurteilung. Dieser bezeichnet Situationen, in denen aus dem Auftreten eines Merkmals (z.B. großer Wortschatz eines Schülers) auf das Vorliegen eines anderen Merkmals (z.B. hohe Rechtschreibkompetenz) geschlossen wird. Gerade dann, wenn viele Schüler hinsichtlich mehrerer

Merkmale oder nicht genau beobachtbarer Eigenschaften eingeschätzt werden sollen, kann es zu logischen Fehlern kommen (Jürgens, 2005).

Fällt ein Lehrer ein Urteil über einen Schüler, so ist die Wahrscheinlichkeit hoch, dass seine nächsten Urteile zum selben Schüler nicht stark vom ersten abweichen. Diese Wirkung des ersten Urteils auf die folgenden, meist auf die Leistungen innerhalb eines Schulfaches bezogen, wird als Perseverationstendenz bezeichnet (Rieder, 1990). Insbesondere bei der Beurteilung schriftlicher Arbeiten ist der Effekt bekannt, dass Lehrer die ersten Arbeiten strenger beurteilen als die letzten

(Baurmann, 1995). Hinzu kommt eine Wechselwirkung mit der Höhe der Leistung, indem z.B. eine schlechte Leistung als noch schlechter bewertet wird, als sie eigentlich ist, wenn sie auf eine sehr gute Leistung folgt.

Während einige der aufgeführten Urteilsfehler an die Beurteilungssituation gebunden sind, werden andere maßgeblich von der Lehrer-Schüler- Interaktion beeinflusst. Zudem können einige der genannten Urteilsfehler durchaus in Abhängigkeit vom zu beurteilenden Schüler mal stärker und mal schwächer (oder gar nicht) ausgeprägt sein, andere hingegen treten eher schülerunabhängig auf und sind auf Eigenschaften des urteilenden Lehrers zurückzuführen. Das Erkennen der Anfälligkeit der eigenen Wahrnehmungen für Verzerrungen ist nicht einfach und die Trennung von Persönlichkeit und Fachleistung von Schülern keine Selbstverständlichkeit (vgl. Rieder, 1990). Umso wichtiger erscheint es für Lehrkräfte, dass sie ihre Motive, Einstellungen und Werthaltungen kontinuierlich hinterfragen und ihre Urteile regelmäßig und systematisch selbst überprüfen.

4. Ausblick: Vorschläge zur Verbesserung der Bewertung und Beurteilung

Lehrerurteile sind nicht perfekt, die vermutlich auch nie sein werden. Eine zuverlässige Bewertung und Beurteilung von schulischen Leistungen und Schülereigenschaften ist schwierig und fordert jeden einzelnen Lehrer in den vielfältigsten Unterrichtssituationen heraus. Dabei darf nicht vergessen werden, dass an Lehrer nicht dieselben Maßstäbe angelegt werden dürfen wie an standardisierte Bewertungsverfahren. Der Unterricht läuft im Allgemeinen nicht standardisiert ab, und man kann nicht erwarten, dass Lehrer Leistungen rein technisch und ohne Berücksichtigung anderer Faktoren bewerten.

Den Lehrern sieht man nicht an und man kann es auch nicht durch Zulassungs- oder Einstellungstests feststellen, ob sie gute Bewerter oder Beurteiler sind. Diese Eigenschaft tretten in der individuellen Konstellation mit den Schülern auf.

In diesem Beitrag wurde offenbart, dass sich Lehrer offensichtlich zu stark von allgemeinen Eindrücken, eventuell auch vorhandenen Stereotypen leiten lassen statt ganz objektiv ausschließlich von Leistungen. Wie kann man nun Lehrer und Lehramtsanwärter dahingehend in Ausbildung und Praxis zu unterstützen?

Lehrer verfügen bei der Bewertung und Beurteilung ihrer Schüler über teils erhebliche Freiheiten und Dispositionsspielräume. Für sie besteht keine Verpflichtung und auch keine Rechtfertigungspflicht für wissenschaftlich exakte Bewertung und Beurteilung, was sich auch darin ausdrückt, dass Berufsanfänger Grundkenntnisse und Fähigkeiten dafür erst im Berufsleben und nicht bereits während der Ausbildung erlernen und erwerben (vgl. Lüders, 2001). Dies liegt nicht zuletzt daran, dass nach wie vor eine verbindliche pädagogisch-diagnostische Grundausbildung in der Lehrerbildung fehlt.

Schule soll Schüler nicht nur einfach für das Leben qualifizieren, sondern dabei jedem einzelnen auch gleiche Entwicklungsmöglichkeiten bieten. Den Lehrerbewertungen, die mitunter richtungsweisend sind, kommt dabei ein besonders wichtiger Stellenwert zu, weshalb sie hohe Erwartungen an Objektivität und Fairness erfüllen sollten. Der große Handlungsspielraum, den Lehrer für ihre Beurteilungen haben, reicht von der Orientierung an verschiedenen Bezugsnormen (vgl. Rheinberg, 2006) bis zum Einbeziehen weiterer Kriterien. Dies kann funktional sein, wenn die zugrundeliegenden Kriterien transparent und nachvollziehbar offenliegen. Da dies oftmals leider nicht der Fall ist, ergeben sich fast zwangsläufig Ungerechtigkeiten, die u.a. in der Notengebung oder den Übergangsempfehlungen ihren Niederschlag finden.

Umso wichtiger ist es deshalb, dass sich Lehrer dieser Einflüsse bewusst sind. Nur wer die Mechanismen im Urteilsprozess kennt, kann ihnen beispielsweise durch besonders gründliches Reflektieren und Hinterfragen der eigenen Beurteilungen entgegenwirken, um sie zu vermeiden.

Ratsam wäre der Austausch zwischen Lehrkräften. Durch gemeinsamen Austausch zwischen beteiligten Lehrern ergeben sich vielfältige Möglichkeiten, voneinander zu lernen. Klassenübergreifende Vergleiche können den eigenen Horizont erweitern, Vermutungen über Faktoren der Schülerleistungen, die möglicherweise nicht beachtet wurden und so zu Fehleinschätzungen geführt haben, können zusammengetragen werden. Auch Regelmäßige Wiederholungen der Leistungseinschätzungen, zum Beispiel am Schuljahresende, die wiederum im Kollegium gemeinsam besprochen werden, können als Überprüfung darüber dienen, ob sich Diagnoseleistungen in der Zwischenzeit verbessert haben (vgl. Schrader & Helmke, 2005).

Leistungsbewertungen müssen Diagnosse, Prozessorientierung und Fehlertoleranz leisten und sollen dazu dienen, das Lernen zu verbessern, und zwar durch zielgerichtete Lernangebote, individuelle Fördermaßnahmen und konkretes Feedback.

Das Bewerten und Beurteilen von Schülerleistungen zeigt eine Professionalisierung im Lehrberuf. Daher sind Beurteilungskompetenzen vermehrt an der Universität vorzubereiten. Ein direkter Förderansatz könnte in der Stärkung dieser Wissenskomponenten liegen. Wichtig wären in diesem Zusammenhang vor allem vermehrte institutionelle Angebote, z.B. während des Studiums, die zum Aufbau dieser Wissensinhalte bedeutsam beitragen könnten.

Es wäre unrealistisch zu erwarten, dass auf diese Weise Lehrer zu perfekten Bewertern werden. Die Überwachung der eigenen Bewertungs- und Beurteilungsleistung ist eine Daueraufgabe. Der kompetente Bewerter und Beurteiler zeichnet sich gerade dadurch aus, dass er seine Kompetenzen ständig kritisch überprüft und versucht weiterzuentwickeln (vgl. Helmke, 2004) und dies als wichtigen Bestandteil seiner Professionalität ansieht.

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PROJECT BASED STEM

Şermin METİN*

Introduction

With globalization, the world has become a small village. However, countries have a different place in this global village with their economic and technological development levels. This has turned into a race between countries, and progress in technology and science has become a way of bringing countries to the forefront in this race. For this reason, investment in science and technology has been seen as an investment in human, investment in human has been seen as an educational investment, and countries that have succeeded in developing, transforming and changing their education practices according to the requirements of the 21st Century have moved to the tops of the global world.

The 21st century, called the information age, requires new generations to acquire certain skills. In addition to having science, engineering, technology and mathematics skills abbreviated as STEM (Science, Technology, Engineering, Mathematics), as well as productive, creative, collaborative, communication skills, Century skills have come to the forefront. Attaining the developments by using STEM disciplines besides 21st-century skills has been centred on training applications. However, knowing the requirements of our time do not mean applying these requirements to teaching. In the mid-20th century, the nature of instructional practices is questioned for the learners of the age of consciousness, which has begun to be contemplated, and intensive research and applications have been conducted in recent years, and intensive intellectual efforts are being made for effective applications.

The information on how people learn has changed greatly in the last decade. Contrary to traditional conveying the topics in isolation have begun to realize that does not support the learning of children and achievement in learning has begun to take place with the student being at the centre of the experience, with interdisciplinary and contextual relationships (Sneideman, 2013). Combining STEM disciplines with education has become one of the key issues considered both in Turkey and all over the world. The project-based teaching approach, which has been implemented for many years and has positive feedbacks, appears to have formed a consensus among many researchers on the fact that it is one of the most effective ways to integrate STEM disciplines in education. Project-based learning is an important approach to the implementation of

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STEM disciplines since project-based learning, which is based on constructivism, is a child-centred educational approach, requires that the learners have to inquire, investigate deeply based on a question, be responsible for their own learning, and requires to use all the disciplines of the STEM.

What is STEM?

In 1957, the success of Russia in space work created fear in America and inspired the competitive nature of America. In 1958, the National Aeronautics and Space Administration (NASA) was established and became the world leader with the students who graduated from the engineering. In the following years, the rapid progress in the technology field of countries such as Japan, China, and Korea obliged America to make fundamental and rapid changes in science, engineering, mathematics and technology fields. In the US, efforts to the STEM (Science, Technology, Engineering, and Mathematics) have been intensified and intense efforts have been made to introduce teacher education, curriculum support and standards (Mohr-Schroeder, Cavalcanti and Blyman, 2015). Today, efforts to develop innovation, technology and scientific literacy to determine the economies of countries have led them to seek strategies to develop younger knowledge and skills (Baran, Canbazoglu-Bilici, Mesutoğlu and January 2016). This intense effort in the United States has led developed and developing countries to move to the STEM.

The industrial revolution has made it necessary for all children to learn to read and the technology revolution has made it critical for all children to understand STEM and the belief that STEM seeds must be reaped early for a good future (McClure, Guelness, Clements, Bales, Nichols, Kendall-Taylor, & lt; / RTI & gt; and Levine, 2017). Skills such as creativity, critical thinking, problem-solving, and co-operation that are sufficient to be only a fraction of the society for centuries are seen as a kind of "universal literacy" to survive in the 21st century. Because STEM approach gives children an interdisciplinary point of view from an early age and contributes to the passing of information in concrete terms, today's information and communication age places STEM at an important place. Turkey STEM Education Report (2015) states that the skills such as creativity, critical thinking, problem-solving and collaborative work does not seem possible to be gained by the children with classical approach to education which has industry area format. In recent years, the importance of the relationship between STEM disciplines and labour has been recognized, and the importance of efforts to encourage and prepare new generations for their orientation has increased (Maltese and Tai, 2010).

STEM involves the application and integration of science, technology, engineering and mathematics into one and encompasses all the processes

from pre-school to higher education (UMASS, 2011).STEM education is an interdisciplinary approach in which rigid academic concepts are combined with the real world, giving students opportunities to practice in contexts that link science, technology, engineering and mathematics to school, society, the business world and global enterprise (Mohr-Schroeder, Cavalcanti and Blyman, 2015). Rather than an abbreviation, the STEM is indeed a philosophy. The STEM is a way of thinking that emphasizes that all levels of educators, including parents, should encourage children to integrate into their knowledge interdisciplinary and to think in a holistic way (Sneideman, 2013).

The STEM disciplines include a set of core processes and practices, build on each other and develop in relationship with one another (Early Childhood STEM Working Group, 2017). STEM education is very important in terms of enabling the theoretical knowledge to be transformed into practice and product. New Era expects individuals to be producers; this necessitates individuals to have sufficient knowledge in many areas to be able to demonstrate their productivity (UMASS, 2011).

Although there are no longitudinal studies to track the effects of early experiences in each of the STEM disciplines, many studies show that early mathematics success affects the mathematics and literacy skills of the following years. Children who are experiencing early experiences and who are aware of having STEM skills tend to have confidence, curiosity, and ability to understand basic STEM disciplines in later STEM education(Early Childhood STEM Working Group, 2017) and raise awareness of science and engineering concepts (Barrett, Moran and Woods, 2014).

The primary focus of STEM education is to provide children with competencies to meet the needs of the 21st-century workforce (Quang et al., 2015).STEM applications provide meaningful learning by systematically integrating knowledge, concepts and skills. Through the created learning environment, knowledge is directly experienced, implemented, tested, or audited by students. Thus, thinking about complex problems involving STEM disciplines has an impact on children's success (Holzer, 1994; Moore et al., 2014; Springer et al., 1999; Tseng et al., 2013).Children learn concepts from different disciplines in different contexts naturally interacting with them (Sneideman, 2013).

STEM contributes to the development of the children's skills such as communication, high-level thinking, collaboration, problem solving and creativity. Children participating in STEM practice make a progress in their perceptions of learning and thinking, develop a positive attitude, learning occurs in appealing, motivating and relevant contexts. However, failure to achieve high-quality STEM experience may result in failure, or

a low-level STEM experience may cause children to lose interest or lose confidence in these issues (Early Childhood STEM Working Group, 2017; Kirschner, Sweller and Clark, 2006). Research shows that there are large differences in mathematics and science among children from different socio-economic conditions and that these differences tend to persist. For this reason, it is thought that STEM education will reduce these differences and fill permanent gaps in early learning (Early Childhood STEM Working Group, 2017)

There are different approaches to integration of STEM into education. Quang et al. (2015) state that three approaches are used in STEM applications: Silo Approach, Embedded Approach and Integrated Approach. The embedded approach is an approach in which the teacher plays an important role and the STEM disciplines are segregated by the teacher. The embedded approach involves the use of information to solve real problems in social, cultural and different contexts. The integrated approach is an approach in which children are expected to use multidisciplinary STEM concepts to solve real-world problems. Smith & Karr-Kidwell (2000: 22) point out that there are two approaches to STEM education: traditional and integrated. While the traditional approach is to acquire STEM disciplines of science, technology, engineering and mathematics independently, integrated STEM education is a method aimed at integrating at least two disciplines and linking it to real life. For this reason, STEM applications require more research and project-based approaches rather than traditional course-based training strategies (Breiner et al, 2012).

Project Based Learning (PBL)

PBL is a program that is based on the idea that children go out of their way to ask questions that awaken their natural curiosity, take responsibility for learning by interacting with the environment, recognize concrete, perceptible events, objects and situations, perform questioning-based individual, small group, sometimes with all classroom members in-depth research with a guide- (Bryson 1994, Katz 1994, Capraro and Slough 2009, and Katz and Chard 2000, Bell 2010). Based on a constructivist learning approach, the roots of PBL are much more deep-rooted. In the late 16th century, it began to be used as an educational method in Italian schools, especially in architecture and engineering and became a tradition in American schools towards the end of the 19th century with the work of Francis W. Parker and John Dewey. (Burlbaw, Ortwein and Williams, 2013; Knoll, 1997).PBL's intellectual rationale comes from psychologists and educators such as Friedrich Froebel, William James, G. Stanley Hall, Francis W. Parker, John Dewey, William Kilpatrick, Vygotsky, Bruner and Piaget.(DuCharme 1993, Railback 2002).Today it has been a major

contributor to Lilian Katz and Sylvia Chard for the revitalization of PBL and its use in early childhood years.

In PBL, which is an intensive research process through carefully planned projects and real-life questions, the active student is transferring his knowledge and skills to the learning environment (Elder, 2003).PBL, an interdisciplinary approach, is an approach in which experiences are determined by children's ideas, questions, theories, estimates, and information.(Capraro and Slough, 2009, Erdoğan and Bozeman, 2015, Lee Keenan and Edwards 1992, Rosberg 1995, Souto and Lee 2009, Şahin, 2013).

In PBL, the aim is to grasp concepts and principles rather than learn facts, to provide them with separate skills and to develop existing skills (Thode, 1997, Demirel, 2003; Newell, 2003). In PBL, project, project or project development means imagining, planning; emphasizes relational learning with a specific purpose rather than individual learning (Thode, 1997). In PBL, which arises from real need or a problem and a divisive and creative process, the problem progresses as a search for a solution, identification, solution requirements and limitations, and evaluating it by producing alternative solutions, and it continues with the group (Thomas, 2000, Uzal, G., Erdem, A., Ersoy, Yasar, 2012) and results in a product or performance (Mioduser and Betzer, 2007).

Katz and Chard (1998) emphasize that PBL has four goals which are knowledge, skill, tendency / creation and emotion. Information is the components of the mind such as facts, events, concepts, ideas, phenomena, connections, topics. Skills include basic academic skills (reading, writing, speaking, measuring, and addition), scientific-technical skills (knowledge management, using the computer and scientific tools, observation), social skills (cooperation, discussion, interview, negotiation, teamwork) and personal relationships (taking and giving, assertiveness, liking, etc.). Tendency/creation is defined as permanent mind habits (determination, curiosity, generosity, ambition, problem-solving, reading skill, foresight, and explanation), working approaches (inquiring/seeking, insisting, deep thinking, openness), preferences (together / alone, longer / shorter time, active / passive and strength / weakness, supporting the use of injured ones). Feelings include feelings of belonging, self-esteem, trust, competence and incompetence, ability and inability (Katz and Chard 1992, 1998, 2011, Chard 1998a, 1998b).

Project-based learning; organizes learning around projects, it is based on difficult questions or problems that students have with design, problem-solving, decision making and research activities,(Chin & Chia, 2004) and supports children's scientific process skills (Panasan and Nuangchalerm, 2010). In PBL, actively participating children in the whole process is an

important strategy for educating independent thinkers. Children evolve using this child-friendly, motivational approach, gain emotions and positive learning experiences and important skills that will form a strong basis for the future of the global economy (Bell, 2010, Papastergiou, 2005, Cakici and Turkmen, 2013).PBL also provides students with problem-solving, decision making and research opportunities (Panasan & Nuangchalerm, 2010), Technology and scientific principles are applied to solve problems with PBL which is a learning method based on project development, imagination and planning in terms of students (Kalaycı, 2008; Kol, 2012).

Project Based STEM

The role of project-based learning in science, technology, engineering and mathematics (STEM) education has been very popular since the early 21st century (Thomas, 2000). PBL is not new but its integration with STEM education is new (Burlbaw, Ortwein and Williams, 2013). PBL is a pedagogical approach that provides contextualized, real experiences that are essential for children to reliably base their concepts of strong science, technology, engineering and mathematics (Capraro, Capraro, & Morgan, 2013, p.2). Increasing the quality of PBL is a significant factor in ensuring that learners have ideal post-graduate 21st-century skills and are STEM professionals (Bell, 2010).

Han and Carpenter (2014) emphasize that project-based STEM has four key characteristics: self-regulating learning, collaborative learning, interdisciplinary learning, technology-based learning and hands-on activities. Project-based STEM applications emerging from the integration of PBL and STEM are an embedded and interdisciplinary teaching approach and are based on the theoretical background of constructivism in which children engage in problem-solving, first-hand experience, interactive group work through open-ended questions (Capraro & Slough, 2008; Clark & Ernst, 2007). Project-based STEM allows children to understand the STEM disciplines in depth and create their own knowledge, unlike the traditional classes in which the content is transferred (Özel, 2013).

The STEM is seen as a natural component of project work. Because both approaches focus on the investigation. The project-based STEM is an interdisciplinary, student-focused, collaborative and technology-based teaching strategy according to its nature. Through project-based STEM applications, children explore questions they are interested in, all of which are part of a scientific research, create questions based on their own hypotheses, make experiments and observe the results, develop by collaborating with their peers to find solutions (Capraro, 2013; Han, Capraro And Capraro, 2014; Moomaw, 2013; Özel, 2013).

Traditional classes are far from supporting children's interest in STEM disciplines and supporting their existing knowledge (Han, Capraro and Caprora, 2014). Integrating STEM education with project-based activities has the potential to improve learning quality and desire (Gallant, 2010). Because Project-based STEM requires analytical and critical thinking because it requires learning-oriented, probing, interaction and cooperative learning based on the provocative and motivating nature of the research, it is a way for students to build engineering designs based on the knowledge they conceptualize with science, mathematics and technology (Erdoğan and Bozeman, 2015; Burlbaw, Ortwein, and Williams, 2013). The project-based STEM will support children for STEM and in their career planning for STEM disciplines, and develop skills in overcoming or reducing regressions or disappointment in these disciplines (Egenrieder, 2010)

Studies examining the effects of the PBL approach in the STEM classes show that in the STEM classes integrated with the PBL, the students had a positive influence on their learning interest and their belief in the usefulness of the STEM disciplines. Research on project-based learning demonstrates that PBL can improve children's knowledge of science, technology, engineering and mathematics (Baran & Maskan, 2010; Han (2017 Laboy-Rush (2017), support children's communication and collaboration skills, and contribute positively to academic achievement (Dominguez & Jaime, 2010; Han, Capraro, & Capraro, 2015; Tseng et al., 2013). Many studies by Han, Capraro & Capraro (2014: 4) show that project-based STEM also positively affects non-academic performances of students, positive attitudes of children on learning, group communication and cooperative behaviours and that children are less likely to leave school. The research similar to the study of Erdogan and Bozeman (2015) appears likely to lead to greater success in reaching STEM content knowledge through experiential, first-hand and student-directed projects for students.

Conclusion and Recommendations

Student-centred, project-based learning that is based on real-life experiences, based on research and inquiry, and involves learning by doing is an approach that enables many skills to be acquired beyond the STEM disciplines. For this reason, STEM disciplines integrated with project-based learning have the feature of being an important teaching method for children to acquire basic skills in science, technology, engineering and math skills.

Project-based learning approach in all stages of education, especially early childhood years in which basic skills required for science, technology, engineering and mathematics are acquired, positive beliefs are developed toward learning, is an important step to reflect STEM and the STEM integrated with project-based learning into learning environments.

For this reason, teacher education on project-based STEM practices is viewed as an important responsibility of all stakeholders responsible for the extension of the curriculum, the development of standards and the training of future learning environments.

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TEACHING PASSION

Ramazan TOPUZ*

Introduction

"The purpose of educational activities carried out at schools should not be perceived as contributing to the individual's mental development alone. The purpose in education is to develop the individual as a whole "(Seidentop, Mand and Taggard, 1986). It is also envisaged to provide physical, emotional and social developments in addition to the mental development of individuals in education and training activities carried out in accordance with the contemporary educational approach. Various lessons are taught in schools for the development of individuals as a whole. Physical education course is also one of these courses. Physical education is the process in which a person intentionally alters his/her behavior in accordance with the purposes of physical education (physical, emotional, social, and mental) by participating into the physical movements. Unlike other fields of education, "movement learning and learning through movement" is taken as a basis in physical education course. In other words, physical education is "the training of man through physical movements" (Tamer and Pulur, 2001).

It is the young generation who will shape the future of the country. Teachers are the ones who will shape the future of the younger generation. Teaching is a profession with a high risk of being adversely affected by unique and intense stressful situations in which people are influenced by the educational environment in particular the mental health of the individuals and, consequently, their working lives. "Working under adverse conditions and stress can cause deterioration in the quality of the services provided by teachers and also affecting their health as an individual" (Baysal, 1995). "In order to achieve success in education, there is a need for educators who can understand the student well, establish a dialogue, direct them, and develop their abilities in the best way" (Uğur, 2006). In this context, the teacher's feelings and teaching passions play an important role in the learning-teaching process as an educator.

"The teaching passion is a feeling that is composed of many different variables. When the meaning of passion is examined, it seems to have a very comprehensive content. Teachers' teaching passions do not have to be one-way. The source of passion for individuals may be different "(Karaman, 1999). Fried (2001) noted that " teachers may have a passion

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for their field knowledge, the events in the world, or against children" and Day (2004) also stated that "the passion of the educators may be directed towards the students, the school and the society". In addition to these explanations, Fried (2001) stated that "a good teacher can not always be a passionate teacher, not only the fulfillment of the tasks required by the teaching profession will reflect passion, but also the commitment to the mission will take place in this context." All the individuals who are involved in the education system must have a passion for teaching. " In short, it is possible to say that the emotional development of teachers has also gone through a change "(Karaman, 1999).

Teachers' passions may show structural differences. In this context, it is very important for physical education courses' teacher who conducts the physical education and sports courses that take movement learning and learning through movement (Tamer and Pulur, 2001) as basis to know how the concept of teaching passion, which directs feelings, shows continuity; which stages and in what circumstances these passions may differ. "It is now stated that the expectations from the teachers have increased rapidly in the education system, not only in the academic field, but also in the affective field, where teachers have given serious tasks "(Karaman, 1999). In meeting these expectations, some of the researchers state that teachers with era's requirement can be trained by focusing on teacher training and some other also emphasize the need for a teacher who has certain personal and professional characteristics. In this context, Karaman (1999) stated that "teaching passion and enthusiasm are one of the characteristics that teachers should have."

"A passion for teaching must be found naturally in every teacher. However, it is seen that some teachers do not fully reflect these characteristics due to mistakes in professional preferences, professional problems and some social reasons. It can be observed that this passion has been decreasing and dying off for certain reasons, leading to the abandonment of persons' professions in many teachers.(Karaman, 1999).

Emotion

Emotion; "is a system of organized responses that transforms perceptual, physical, cognitive, experimental and other changes into understandable feelings and moods". (Smith and Lazarus, 1990)Cognitive psychologists have argued that our perceptions of situations and the meanings we give to events constitute the basis of our emotions about them. In other words, our emotional reactions are influenced by our own interpretations of the situation or by the way it is interpreted for us "(Mumcuoglu, 2002).No emotion that we have today is not arisen by chance or by accident. Since all emotions have certain functions, like our

organs, they have been preserved throughout the evolution process and has reached today. The general function of emotions is to adapt to nature and society. So we increase our chances of survival and being able to hold on to this world. Also, people need emotions as a source of motivation to sustain lives; as well as to increase the level of existence and to live quality." (Dennis, 2010) Researchers who are examining the structure of emotions have determined that all emotions do not occur in the same way and they have studied emotions in two different groups. "Primary feelings are interpreted internally as natural responses to events and situations (such as happiness, sadness, fear, anger, confusion). In contrast, the secondary feelings have more complex structure. They are mostly gained from social relations and are linked to the social and personal development of the people (shame, jealousy, guilt, honor) "(Day, 2004).

Goleman (1995/2011) who defined the feeling as “a feeling and a specific set of thoughts specific to this feeling, psychological and biological states, and a set of movement tendencies” states that “we can say hundreds of emotions with mixtures, variations, mutations and nuances, and in fact the nuances of feelings are much more than the words that describe them ". Goleman (1995/2011) suggests that although there is no consensus on exactly what are the prime or primary feelings that bring about all the emotional mixtures, but there are basic emotional clusters described below are the subject matter:

- Anger: Fury, insult, indignation, wrath, exhaustion, anger, irritation, vindication, grudge, resentment, hostility, and an extremely pathological hatred and violence.

- Sadness: Pain, grief, joylessness, gloom, melancholy, self-pity, loneliness, boredom, despair and depression (when pathological).

- Fear: Anxiety, delusion, irritability, worry, wonder, doubt, wakefulness, remorse, restlessness, hesitation, fright, horror, phobia and panic (when pathological.)

- Enjoy: Happiness, enthusiasm, relaxation, satisfaction, pleasure, joy, amusement, pride, sensual pleasure, excitement, a case of ecstasy, pleasure, self-pass, extreme fitness, whimper and mania (as extreme case)

- Love: Acceptance, friendship, trust, goodness, close attention, loyalty, admiration, conversation, extreme passion.

- Perplexity: Shocked, amazed, consternation, curiosity.

- Disgust: Contempt, humiliation, disdain, disgust, dislike, hate, unattractive

• Shame: Guilt, embarrassment, disappointment, regret, humiliation, worry, hank contrition (Goleman, 1995/2011).

Emotions also play an important role in learning and decision-making processes. While a bad feeling that comes out of a wrong decision provides that the same mistakes are not repeated in the future; satisfaction ensures empowerment of experience "(Epstein, 1998). Nias (1996) stated that "emotions and minds constitute an integral whole in the learning process, and that trying to separate them leads to an inadequate perception of teaching and learning".Zembylas and Vrasidas (2004) have stated that "it is very meaningless to discuss the importance of emotions, which are already present in the process of learning and teaching, and even an inseparable part of education", also argued that “rather than discussing these, the debate to discuss what the absence and presence of certain feelings depends on is much more important.”

Robert Solomon, who has made a detailed analysis of passion, emphasized the difference between feelings and emotions in his work, thus provided a useful insight into the difficult conditions and developments that new teachers would encounter. Robert Solomon (1993) stated in his study that: "Feeling is a set of judgment-ideas or provisions - decisions created by our world, our environment and the volitional objects within them. Emotion is the reflection of our basic provisions about ourselves and our place in this world and our values, ideas, structures and mythologies that we live in. my sadness, my pain, my sorrow is the judgment I have formed as a result of a sad situation that I fall into with a lost cause. In short, emotion is an expression which is open to evaluation and formed a result of my situation, my own and other people's decisions. "(Akt: Karaman, 1999).

Emotions in Learning-Teaching Process

It is accepted that the heart of human relations is the communication, the heart of communication is also emotions. The expression of emotions is very important for an effective communication which is the basic requirement for successful human relationships. People use feelings as means of communication. Individuals give clues about themselves by voicing their emotions or by their mimics. The information given with these tips constitutes the first step of the relationships. Emotions ensure one to grasp situations well, accurate perceptions about the events, and be in the right judgments. The rationality of the person is very closely related to his/her emotional experience. Individuals who have a healthy emotional life exhibit reasonable behavior and make correct determinations. In this context, it is accepted that emotions are complementary to logic "(Planalp, 1999).The importance of emotions in the education and training system is known for many years. However,

except for the work done to avoid the difficulty of implementing some educational policies, positive and negative emotions that resulted from the teachers' experiences were not researched deeply and measures were not taken against them. (Karaman, 1999).Sutton and Wheatley (2003) emphasized the two most important reasons why teachers' emotional work began to take place only in recent years and stated that "this is why the research on the emotional subject emerges in much later days than other issues in Psychology, and that people have some prejudiced thoughts from the past about emotions ".

The emotions should be an integral part of the education system. However, this may have some drawbacks. First of all, educators may not have the qualifications required in the training of emotions. Nevertheless, it should not be overlooked that teachers teach emotions day by day. At the same time, teachers need emotional development and support as individuals.(Karaman, 1999).

Beck and Kosnik (1995) emphasized "the importance of the creation of school environments and the training of educators or the orientation of the profession to the classroom, where emotions can be freely expressed, creating the joy and desire for learning".

Passion

Looking at the historical development of the concept, it is seen that the first Western philosophers used the concept of "passion" rather than the concept expressed as "feeling" today. "In the discussion about virtue and sin in Plato's dialogues, Aristotle's Rhetoric, and Greek mythology, it is seen that passion is used instead of feeling concept. Despite the fact that concept was found in the 1290's for first use for strong emotions and desires, the use with a more general liking, enthusiasm and enthusiasm started in 1638 "(Bennet, 2005). In the Glossary of Terms of Psychology, passion is defined as "a strong enthusiasm exceeding will and judgment". ENA, 1990). In this context, passion is an emotion which is effective on people's choices and behaviors. Vallerand and Houlfort (2003) defined passion as "a strong desire for activities that people find important and waste labor and time for it, and they divide the passion into two: harmonious and obsessive passion. Harmonious passion is an independent internalization that directs a person to take part in a loved activity, while the obsessive passion defines as a controlled internalization of action that creates an internal pressure to take part in the person's favorite activity. " From a biological point of view, passion is a biological process in which a feeling (that can be observed from the outside) or emotions (which can be observed from inside) or the outcome of the external environment and events. In short, passion, one of the most powerful emotions, is shaped by the same biological influences as the

emotions and from external influences. However, it is also true that emotion is not just a biological structure. Passion is perhaps one of the most meaningful among emotions. People go around the world for their passion, in some cases they leave their loved ones, the land where they grew up, and even their own individual needs. Even when the basic needs of people are met at a minimum, or even when these needs are not adequately met, some people may have an irresistible desire to learn wisdom, new things, discover different worlds. This is may be named as " intellectual passion (Karaman, 1999). Taking into consideration the content discussed in the definitions, it seems that "passion has a guiding, motivating structure". People can be passionate about certain people, events, objects and causes. Being passionate can create energy, determination, conviction, loyalty, and even obsessions. Passion can cause an effect on two different extremes. The passion that leads to a determined commitment to a truly desired goal opens a new vision for the person, but when the other things are thrown away to an edge, this only also narrow one's angle of view. "(Day, 2004). Positive passion leads to success, negative passion leads to evil. Hegel, a philosopher, stated that "nothing important in the world can be achieved without passion" (Akt: Bennet, 2005).

As with many moods, it may be difficult to distinguish passion from some other emotions. For example, when one person says that I am very happy at the end of an event I went through, probably not the only emotion he/she felt was happiness. She/he felt many emotions at the same time and called it just happiness. This situation is not so different for the concept of passion, which has a more complex meaning and perceiving by the person show differences from negative to positive. One of the most important concepts associated with the passion is the creativity. When Nobel Prize-winning physicist Amabile was asked about the difference between creative and non-creative scientists, he pointed out that successful scientists are not always the most talented people but those who choose to progress twit a certain purpose." (Bennet, 2005).Passion in many cases, such as a burning fire in man, keeps up with the deficiencies of some of the talents to make it go further "(Karaman, 1999).Csikszentmihalyi (1996), "During 1990-1995, he made negotiations with people who made a difference in a certain area and identified 10 common characteristics of these persons. 9th was passionate. Most creative people are passionate about what they do. It is expressed that the passion is the nurturing source of creativity. It is not enough for individuals to come to work just to work. It is expected from them to be excited, emotional and committed to what they do. Only in this way, they can pay attention to what they do, they can go into new quests to improve(Akt: Bennet, 2005).

People can be trained with logical way but can be inspired by their passion, can discover and develop new things. Senge (1990/2011) that "people can naturally proceed with the passions, can naturally create something that really excites them". The primary reason for passions which is inherent in many things is the desire and the will to make a difference. From this point of view, what is important is not what is achieved, but the contribution." "The situation for teachers is not that different, the children they grow up will not have a clear contribution to them in the future, and the students will go their own way. However, the teacher's contribution and effect in this process is the key point for a teacher. This unrequited giving is necessary for the satisfaction of the development and passion of their own feelings (Karaman, 1999). It is stated that the most important basic feelings that can shape the teachers' passions are the feelings "love, enthusiasm, courage, dedication, proficiency etc." (Karaman, 1999). It is possible to explain these feelings in paragraphs as follows:

Love; "is one of the most important conditions of the teaching profession. Whether described as good or bad; one teacher, even an ordinary person needs to have human love. For a person who has no human love moreover child love, it does not make any sense to be a teacher. Love is the most natural way of communication "(Karaman, 1999). "Teaching is a matter of both intelligence and emotion. Love creates a common struggle by providing new perspectives to individuals in many ways "(Liston and Garrison, 2004).

Love is the foundation of education. Education kneaded with love constitutes a source of peace. Since the teaching profession is the profession of human raising and human gain; human love must be found in every teacher because human gain can only be achieved by entering into the heart of the other party, by only through love (Celikkaya, 1996).

Enthusiasm is defined as "a state of temporary admiration or enthusiasm that often arises with a great desire" in Turkish Language Association dictionary (TDK, 2013)Teacher enthusiasm is stated as a clear teacher behavior that affects the learning of the student positively. The reflection of this concept by the teachers which is not easy to define is very important in the teaching system "(Karaman, 1999).Carusso (1982) stated that enthusiastic teacher has the following characteristics; inspire confidence and friendship, ensures compliance of topic with students and exhibit it; apply to rich and animated hand movements to emphasize or consolidate points; creative and diversified in teaching approaches, dedicated to teaching and playful; maintain eye contact with all students; different tone to make the presentation more interesting words; change the meaning according to the place of words and pause;

prominent and animated hand movements; patient; insist on students finish their studies successfully aware of out-of-work behavior and do it right away; maintain a fast course flow ; have a sense of laughter; laugh at themselves; act to keep their attention and interest. (Akt: Cruickshank, Jenkins and Metcalf, 2003).

Courage; is defined as "the confidence that the person has when he or she engages in a difficult or dangerous job" in In the Turkish Language Association's dictionary,(TDK, 2013). Day (2000) emphasizes that teachers' trust and self-esteem should be developed, and courage, one of the essential qualities, must be valued in order to achieve it ". "All the individuals involved in the education process are in need of courage as much as the teachers " (Karaman, 1999).

Commitment: "The dedication, energy and skills of teachers who have made great efforts to fulfill their duties in all countries, in social change and in reform movements, must be supported at all times in their careers. Because one of the most important variables in the development of teaching passion is dedication (Karaman, 1999). In a study by Crosswell and Elliott (2004); it was stated that "Teachers' devotion to external factors (such as students), as well as certain ideologies, values and beliefs, is also an important element of personal devotion.

Competence; is expressed as "the belief in the capacity of the individual to organize e necessary performance to demonstrate a certain activity and successfully achieve it." Teacher competence is expressed by Ashton and Webb (1986) as "the belief that the teacher has the ability to influence students' learning positively" (Akt: Karaman, 1999).

Teacher competence is also expressed as "the belief in the capacity of a person to organize and successfully perform the required activity to fulfill a given teaching task" (Tschannen-Moran et al., 1998).

If the physical education teacher is adequate; this is expressed as the knowledge, understanding, skills and attitudes that must be possessed in order to fulfill the duties and responsibilities of physical education teachers" (Ünlü, Sünbül and Aydos, 2008). "During the historical process, it is seen that the qualifications to be found in the physical education teacher and the individuals who have successfully participated in the teaching programs to earn these qualifications are will be teaching physical education and become teachers." (Demirhan, 2003).In education, "it is necessary for teachers to have competences in some areas in order to make students to reach the desired level. The concept of teacher competence, which has been frequently used in recent times, is an expression adopted by most educators in terms of clearly demonstrating the skills of a teacher candidate who has completed this undergraduate

study "(Kuran 2002). "Teachers' fulfillment of the qualifications required by the teaching profession is directly related to their belief in their ability to fulfill their teaching duties and responsibilities as well as their good education" (Yılmaz, Köseoğlu, Gerçek and Soran, 2004).It is stated that when teachers' 'teaching competencies are taken into consideration, when teachers show higher teaching competencies, students are more enthusiastic and have a significant increase in their mental development" (Bandura, 1994). It is argued that there is a positive relationship between "having confidence in themselves or having positive perceptions about their competences and students' success, motivation and competence; it is believed that their views on the competencies of teachers are one of the most important factors that determine teachers' competences in teaching (Tschannen-Moran et al., 1998).i

Passion in Learning-Teaching Process

"Teaching is actually a complex function of passion. It consists of real and imaginary parts. The social reality faced by most teachers is often ruthless and depressing. This is a story that is constantly being told. The story of their dreams is often silenced. This dream is a result of their passion. Imagination allows them to see what is possible. Teachers use a simple and positive look to protect their students and themselves from the negative forces surrounding them. Once protected from those forces, teachers undertake countless challenges of the educational process. Such teachers are a strong example of all educators, depending on what they do and in what circumstances. Education is a privilege and the basis of privileges "(Bob, 2004).Hartley (2004) has described the following in his article on passion for the learning-teaching process

"Passion to Teach". This is different from being a good teacher. They are not the same topics despite the fact they're linked. When asked how a good teacher is, I would say that the ones who will answer it are students. Things that lead students to a good teacher are an important part of teaching The main things that students demands from a teacher are as below:

-To share the excitement of the subject,
-To be open to the questions
-To acting to the students as a person

Having a passion for teaching is what you get from teaching I taught my first class as an assistant professor ten years ago. I was so passionate about teaching that I prepared my class plan. However, while I was teaching the extraordinary topic which is my field, I expected from class to understand the topic. When I turned back to the class from the board I found my students in a hurry to take notes and not even one face was looking at me.This was an eight-hour preparation for the 1-hour course (I

know it crazy) is this the thank you for this?At the end of the semester I got good assessments from students. But I realized that I needed more interaction. Just like researchers, we are all aware of the existence of a rich literature in past studies. But sometimes it's easy to see other areas as workspaces. In this case, university education is actually a situation where many people spend time developing methods and conducting behavioral studies. For me, the goal was to find methods that could improve class interaction. Fortunately, I did not only reach the goal by researching new methods and I have shortened the length of the lecture t the same time significantly and my students have learned a lot more. In my case, the result was "collaborative learning", classroom group exercises and discussions. this was a complete gain.

Llewellyn (2004) wrote in his article that he wanted from his students who graduated to think about school and asked them the teachers that they can not forget. The best example of a teacher who graduated in 1969 is that a teacher in a school can and should be a teacher. This has formed a measuring standard for all future teachers. So far no one has capabilities that the teacher (John) have. John has always approached each student with respect. Occasionally, if one of us asks a ridiculous question, John makes the question logical with a hand sign, continue to answer that we learn something. The student who asks the question is thus encouraged and will not be humiliated ". A chief physician now remembers for the three teachers that "Three teachers have made a difference in my life. They are kind, compassionate and intelligent" They were a source of inspiration by the support they gave to the students and their dedication to teaching. I encounter people who spend time teaching thus I can be a lucky person throughout my life. " also stated that a student who graduated in 1980 and was a director at a center reported that "professional, challenging but sensitive to his students, I will be grateful for it for life, May he rest in peace " Llewellyn (2004) concluded his article by using the following expressions for the educators working at the university level in the learning-teaching process: "what makes a professor great is the ability to teach." To care about the students is a part of being "teacher" not part of being a professor. The professors should stay in their laboratory and leave the teaching to the teachers. A good professor sees their students as future colleagues and they shape their brains and influence their characters until the end.Fried (2001), in parallel with the above studies, gave the following expressions to his research: "Passionate people are the ones who make changes in our lives. Due to the intensity in their beliefs and their actions, they bind us with the reason that we do not notice our feeling of worth inside and even outside us. This passion is sometimes expressed in a quiet, refined structure, sometimes by creating storms. However, whatever style or form the

teacher's passion emerge, students know that they are in the hands of someone who has an extraordinary dedication to learning. When this commitment is intensely shaped, even if the students feel uncomfortable, they will know that it is really something very important. This is what makes "the teacher memorable.

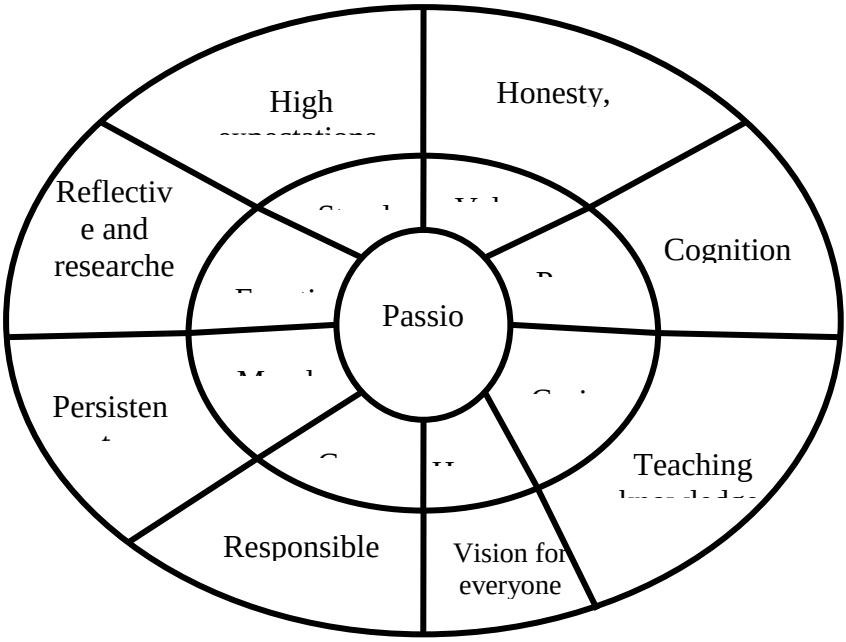
Day (2004) in his study specified that "that all the passionate teachers have three different basic passions regarding they will lead to making a distinct difference in the lives of the students through their own field, for the children they are trained and for their own education style". Day (2004) emphasizes that "passion is associated with enthusiasm, cautiousness, commitment, hope, which are the cornerstones of effective teaching and in addition, being fair and understanding, trying to understand the feelings of others, encouraging students, taking responsibility, being knowledgeable, creating effective environments for effective teaching." Day (2004) has developed a model for the passionate teachers. As it is seen in Figure 2.1, Day (2004), unlike models created by considering only the technical competencies of passionate teachers, adopted "a holistic approach for the development of beginner or ongoing teachers and personal and professional, ideologically applicable, heart and mind appealing."

Figure 1. Components Forming Passionate Teacher (Day, 2004).

As can be seen from the above, ten characteristics of a passionate teacher has been described by Fried (2001) as follows:

1- like to work with young people, has a deep interest in information and ideas

2-do not show their compassion towards the students as an excuse for ignorance and skill deficiencies of the students,



3-Too much exactingness for students,

4-By following the events in the class and the world alive, reflect these different aspects of views into the activities of the students,

5-Natural and serious or having a sense of humor, all of them can be achieved at the same time

6- Natural and serious or having a sense of humor, all of them can be achieved at the same time

7- accompany children with very absurd and meaningless events that children can exhibit in human nature, shows a very serious interest in issues that may cause critical and important consequences, such as equality and children's deserving behavior towards each other,

8- Try to create a culture of mutual respect in the midst of problems such as refusing young people and their views with social pressures to shame non-popular people and thoughts and stamp them in certain ways,

9- always takes risks and therefore makes as many mistakes as any person can make, but instead of ignoring them and countering them, they choose to learn from their experience and learn something,

10- helps to make the classroom environment a safe environment for students to make mistakes and learn,

11- takes his/her mission seriously and reflects his / her beliefs are available (Day, 2004).

"Passion is not one of the goals of education alone" (Olson, 2003). Passion is like a bridge connecting young people's thoughts and life experiences to actions in the school system. Thanks to this communication, students will begin to create certain features, attitudes. One of the most important factors affecting the quality of education in many schools is the passion that teachers have. Success differences between the classes are observed. There may be many reasons for these differences, but the contribution of the teacher to this success, especially the passion, can not be ignored. We can see that most of the changes that have taken place in our lives have been achieved by passionate people "(Karaman, 1999).In the light of the above, it is possible to say that "there are serious differences between teachers who are committed to ethical and moral values, to identify their work with their lives, dedicated to teaching and educating and teachers who see this only as ordinary work" (Karaman, 1999).

"In order for the education system to go to its true values and to be able to pass the real teachers, a passionate answer should be given to those who are focused on the outcome, not just on the outcome but on the opportunities available. Whilst the teachers with a passion for teaching reflect this passion to their students, those who direct the education system should reflect the same passion to all instructors and administrators In order for a training policy to be successful; sharing this passion is as equally important as having a passion (Karaman, 1999). Fried (2001) states that "many teachers start their careers with passion, but as a result of an illusion, this dries and disappear into the blue". It is important to note that "this passion does not belong solely to them. Passion belongs to all students, other teachers, and even the whole school.

Conclusion

The teaching passion of each teacher is not in a standard structure. It can appear in many different dimensions such as show care, student love or dedication to the field. It should be kept in mind that it is useful to determine how the teaching passion is perceived by the teachers and to suggest urgent solutions for the teachers lacking this passion in the education system. Considering the problems caused by institutional

structures are an important factor affecting teachers' passion, it will be useful to create a competitive environment in public schools as it is in private schools and to ensure that this competition is perceived as an opportunity for the professional development of teachers. Thanks to experience, the most important feelings that develop in teachers are; patience, self-esteem and professional competence, it is known that the first years of teaching are of critical importance for the maintenance of profession or for separation from the profession. In this context, it should be known that particularly young and inexperienced teachers' enthusiasm for teaching will always continue to increase by avoiding the separation of profession and burnout through the provision of professional qualifications under the guidance of experienced teachers and administrators, and the introduction of high levels of positive views towards professional qualifications . It should not be forgotten that the exhaustion of the teaching passions of the teachers who give education to the young people who are trying to keep pace with the rapidly changing age change is a great loss for the education systems

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