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## GROUP COUNSELING WITH ADOLESCENTS: PROBLEM BEHAVIORS AND EFFECTIVE GROUP LEADER INTERVENTIONS

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#### Introduction

Adolescence is one of the developmental stages during which physical and cognitive growth takes place rapidly as well as psychological changes. According to the data of Turkish Statistical Institution in 2018, approximately 16% of the population in Turkey is made up of adolescents. The results of the survey on Adolescent Profile in Turkey (TEPA, 2013) indicated that 55% of the adolescents have difficulty adapting to the changes they experience during the period of adolescence. Adolescence, which can also be defined as a period of development of ego identity, individuals may have problems and need support in many issues from family relations to friendship relations, from academic issues to self-esteem. It is a fact that adolescents who have trouble in dealing with these problems encountered during this period and cannot receive adequate help may even display several risky behaviors such as resorting to violence, substance abuse, school drop-out, running away from home and committing crime (TEPA, 2013). Therefore, it is extremely important that individuals can get the psychological help they need in order to complete their development in a healthy way during adolescence.

Considering that 89% of the adolescents aged 12-18 living in Turkey are school students (TEPA, 2013), schools appear to be the most convenient places to reach adolescents and offer them preventive and remedial psychological services. Group studies conducted within the scope of counseling services in schools seem to be advantageous from some aspects. Groups play a role in adolescents' coming together with other individuals who have similar experiences to theirs, sense of belonging to a group and being accepted by their peers, which are specific to this period (Malekoff, 2014; Rose, 1998). In addition, group experience is effective on adolescents in terms of gaining awareness, developing social skills and feeling understood. Groups also have a critical role in facilitating modeling each others' positive behaviors among peers. From school counselors' perspective, group counseling is quite economical as it allows for reaching more students in a certain period of time. Considering the fact that the number of students at schools in Turkey is high in the face of the limited number of school counselors, turning to group counseling is an effective way to reach more students. Besides being economical, group counseling at schools is frequently preferred since it provides the adolescents with the opportunity to use the effect of their peers on them healthily during this process of development and change.

Looking at the types of group counseling conducted in schools, psycho-education and counseling groups stand out. Within the scope of the counselor's informing services, group guidance is often used. In terms of their functions, it can be claimed that schools carry out both preventive and remedial group counseling. Regardless of their type and function, it is

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clear that group counseling is an effective way of intervention in the development of adolescents and solving their problems just like in other age groups (Hoag & Burlingame, 1997). However, some problems may as well be encountered while counseling in groups; some resulting from the nature of the group some from individual and developmental characteristics of adolescents (Gladding, 2008; McMurray, 1992).

This section presents information concerning the definition of adolescence, stages of adolescence, characteristics of the adolescence and developmental tasks, problem behaviors to be encountered in adolescent groups and the interventions that can be used by group leaders in dealing with these behaviors.

## Adolescence Stage and Developmental Tasks of School-Age Adolescents

The Latin origin word adolescence means growing, progressing, developing and maturing (Şahin & Özçelik, 2016). The World Health Organization defines individuals aged 10-19 as *adolescents* and those aged 15-24 as the *young* (WHO, 2019). UNESCO considers individuals aged 15-24 who continue their education, have not started to work to make a living and have not their own home as adolescents (UNESCO, 2019). In the sociological context, on the other hand, youth is defined as a period whose upper age limit is determined according to the expectations of the society from the individual (Koç, 2004).

The period of adolescence is divided into three sub-stages as early adolescence, middle adolescence and late adolescence which are subsequent to each other in terms of developmental characteristics. Early adolescence usually refers to the period between the ages of 10 and 14. During this period, the adolescent experiences rapid physical changes like growth in height, increase in body mass and changes in body regions (Derman, 2008; Kılıçcı, 2006; Kulaksızoğlu, 1998; Parlaz et al., 2012). Thus, the individual tries to adapt to the rapid physical changes s/he is going through (Derman, 2008; Kılıçcı, 2006) and it seems important that s/he has acquired the necessary coping skills to adapt to these changes in a healthy way. Middle adolescence is usually defined as the period between the ages of 15 and 17. The development of the early adolescence goes on during this period while the adolescent also experiences intensive hormonal and cognitive changes as well. Therefore, middle adolescence period can be accepted as the stage during which the foundations are laid for the adolescent's sexual identity development and personality development. In this respect, this period is highly important for the individual healthfully to accept and adapt to the sexual and cognitive change s/he is going through. Late adolescence, on the other hand, usually covers the period between 18 and 21 ages. At this stage, the individual is expected to complete his/her identity development, start establishing close and intimate relationships, display behavior appropriate with his/her roles in the relationships; which features personality development, social and emotional development (Derman, 2008; Erikson, 1977; Kılıçcı, 2006).

In the light of the given stages of adolescence, it is possible to claim that school-age adolescents have certain developmental tasks expected from them. A developmental task is an individual's showing expected characteristics specific to a period and displaying specific behavioral patterns during the developmental stage s/he is going through (Ercan, 2001; Gander & Gardiner, 2004; Kılıçcı, 2006). Based on this definition, developmental tasks expected from individuals in adolescence could be specified as accepting the changes in their body, behaving in accordance with their gender roles, building healthy relationships with their peers, gaining autonomy, acquiring decision-making skills and fulfilling their social responsibilities. In a study aiming at determine the developmental tasks of high-school students aged 18-21 (Ercan, 2001), developmental tasks of adolescents were found to be adapting to physical growth, having a place among peers, selecting and preparing for a job, gaining economic independence, becoming independent of the family, reaching the social statue of an adult, being ready to get married and developing a sense of personal value. Another finding of the study is that an individual who fulfills his/her developmental tasks appropriately has higher self-confidence compared to one who fails to fulfill them, can establish healthy relationships with his/ her peers and others around and experiences a healthier passage to young adulthood. Therefore, it seems that the psychological help and guidance offered to adolescents at schools in the light of their developmental characteristics and developmental tasks is important. In addition, considering adolescents' such needs as being accepted by their peers, taking approval from them and modeling their behavior, it appears that group counseling offered to adolescents by school counselors within the scope of guidance and counseling services has a critical role in terms of development and adaptation (Berg, Landreth, & Fall, 2006). Group counseling comes up as one of the most effective intervention methods that can be conducted with this age group as it allows adolescents to share the mood swings they experience, see that their peers go through similar states to them and get to test some behaviors in a safe environment (Corey, 2012).

#### Adolescents' Problem Behaviors in Group Counseling and Effective Group Leader Interventions

During the process of psychological help, the most desired condition for counselors is to work with smart, talkative clients who arrive at ses-

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sions on time, have high awareness, do not complain about the process, but are willing to set goals and work on their goals instead. Clients may possess one or several of these properties; however, it is not always possible to work with a client who has all of them. Clients usually want to see a counselor to change situations, characteristics, conditions etc. that they see as problems in themselves or their lives. Thus, it is normal that these situations, characteristics and conditions are displayed by the client in the individual or group counseling processes (Fehr, 2004). For instance, during the group counseling process, such behaviors as idealizing the group leader, not taking the floor without being asked to or keeping silent, speaking all the time without letting other group members, constantly approving the group leader, making provocative, hostile speech to other members and the leader, displaying a competitive behavior against others and/or complaining about his/her experience all the time are considered problem behaviors (Fehr, 2004). Yalom (2002) defines challenging members in group counseling as those who are monopolist, silent, boring, rejecting help and complainers. In addition to these, he states that some members can be classified as challenging members due to their psychopathologies besides their personal characteristics. He includes members with schizoid, narcissist and border-line personality disorders into this classification. The classification suggested by Voltan-Acar (2005) individuals displaying problem behavior during the group counseling process are defined as those who are anxious, depressed, silent, have hostile feelings, socialize with other members, have dependency, give advice, are monopolist and create an uproar.

Although several studies make different classifications, problem behaviors observed during group counseling are basically similar to each other in terms of their content. On the other hand, in some studies (eg. Yalom, 2002), it is observed that members with psychopathology are included in the classification. However, in group counseling processes, members with psychopathology are usually excluded; and directed to another support which can be more appropriate and effective. This commonly applies to the counseling processes that are held in schools as well. Based on this fact, in order to define possible problem behaviors during group counseling processes held with adolescents, this section uses the classification suggested by Corey and Corey (2002) which is based on the problem behaviors that result from individuals' existing personal characteristics and are reflected on the group counseling process. Problem behaviors individuals may display during group counseling processes and the strategies that could be used by the group leader when these problems are encountered are presented below in detail.

#### Silence and Lack of Participation

Silence and lack of participation is a state that can commonly be faced in group counseling. Even though the silent member may seem not to be disturbing the group process, this behavior could become a problem for the group after a while as s/he fails to contribute sufficiently to the group. According to one point of view (Yalom, 2002), silent members can find solutions to their problems by listening and observing others; however, from another perspective (Fehr, 2004), silent members are not noticed since they do not express their feelings and opinions and fail to find solutions to their problems actively.

Among the reasons behind keeping silent are politeness, waiting for invitation to speak, not finding valuable enough to tell/listen, feeling that s/he must not speak, worrying about being unable to find suitable words, refraining from the leader and/or other members, showing passive resistance, not knowing his/her roles and responsibilities in the group/uncertainty, fear of acceptance/rejection and the fact that the environment of trust has not yet been established in the group (Corey & Corey, 2002). Moreover, in groups consisting of adolescent members, adolescents may feel peer pressure with the worry that what they utter would be found absurd or funny or they could prefer to stay silent as they have an intensive sense of embarrassment (McMurray, 1992).

During group counseling processes, when these members are intervened, some of them have a defensive attitude claiming that they benefit from listening to others' problems. Such group members frequently utter sentences like "I will speak if I find something important that I can contribute with." (Corey & Corey, 2002).

No matter what the reason is, the group leader should encourage discussing these members' silence through suitable ways but without pressure. One way is to negotiate with the member to speak at each session. However, the leader should not have excessive pressure on the member with his/her intervention and make the member attach more to the role of isolation. If the member says s/he wants to speak but there is no time left for him/her, s/he may be given to call upon to speak first at the next session. Yet, as stated before, these members should not feel that they are being punished, pressured because of their silence, but opportunities should be created for them to speak. The group leader should not refrain from the silent member, and encourage him/her to take responsibility in making the initial step. The interventions of the group leader should be encouraging for the member to think about the meaning of his/her silence and to question himself/herself to find out if s/he is silent only in the group or outside as well (Corey & Corey, 2002; Yalom, 2002).

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Interventions focusing directly on the silent member may cause adolescents to obstinate with the leader, feel under pressure and get more introverted. Therefore, instead of focusing directly on the silent member, asking the question "Has everyone already spoken?" may help the member participate in the group (Carroll & Wiggins, 2001). Another method to be employed is that the leader starts an activity which will enable each member to express their feelings and opinions at that moment. Such activities in which everyone takes his/her own turns are useful to enable silent members to express themselves and face their anxiety (Trotzer, 2006). Focusing on the group's feelings and opinions about the silent member and how the group reacts to the member can be another effective way. Attention should be drawn on what the other group members feel or think when the member stays silent. The silent member can be asked such questions as "How does it feel to be in the group, if s/he wants to do anything to participate verbally" etc.

#### **Monopolistic Behavior and Storytelling**

Silence and monopolistic behavior are the problem behaviors at the two ends of a line in group counseling. A member displaying monopolistic behavior constantly places himself/herself in the center during group discussions. Such members contribute to everything shared in the group and associate the details in the other members' stories with their own stories and talk about themselves all the time. They block other members from speaking because of their need to explain and talk about themselves (Corey & Corey, 2002; Yalom, 2002). Such members usually misunderstand self-disclosure. For example, some members consider talking about their past, details of their experiences or stories as sharing in the group. However, being verbally active is not always mean as proper self-disclosure (Carroll & Wiggins, 2001). When story-telling members speak, the group leader and other members move away from the process and the aim of it. This reduces the effectiveness of the group counseling process.

One of the main reasons behind monopolistic behavior and storytelling is explained with the member's anxiety. According to this perspective, the member has a very high level of anxiety, which shows itself with talking all the time. The member tries to deal with his/her anxiety by talking constantly (Corey & Corey, 2002). In addition, it is possible that this behavior is displayed in order to avoid questions and going deeper about him/ her by keeping other members' attention on his/her speech. From another point of view, this behavior is the need of members who want to have control reflected on the group experience. By doing so, the constantly talking member is, in fact, trying to keep the topic going around the axis s/he wants (Corey & Corey, 2002). Adolescent group members may display monopolistic behaviors to draw attention or impress someone in the group in certain cases (McMurray, 1992).

In order to avoid disruptive effects generated by these members, the group leader may explain the difference between so-called self-disclosure and deep and intimate self-disclosure while structuring the process. It should be remembered that members could told more stories in the group at the initial stages. At this stage, it is clear that storytelling will result from such feelings and thoughts as resistance, anxiety, fear and uncertainty. If this continues, the group leader should first be aware of the fact and work on it together with the group and the members (Corey & Corey, 2002; Fehr, 2004).

While members understand towards such members at first, it is very likely that they tend to lose tolerance, get uneasy and start to feel annoyed in time. If this is the case, it is very important that the group leader conveys what other members want to say about the monopolistic member to the group process in an appropriate way (Carroll & Wiggins, 2001). However, in adolescent groups, group members may display hostile behaviors when expressing their feelings for the monopolistic group member. In such cases, the leader should interfere with this and ensure that the group gives constructive feedback (Carroll & Wiggins, 2001).

The group leader may react to the monopolistic member as follows: "You talk frequently and I realize that you generally try to define the problems you have. You tell stories and I often have difficulty following you. Sometimes I get confused about what you want to tell. What do want me to hear most?" or "I see that you want to tell us a lot. I want you to go to members at different spots of the room and complete these sentences. "The thing I want you to know me about most is...", "If I did not speak...", "I have a lot to say because ... ", "If I let others speak ... ", "I want you to listen to me because..." (Corey & Corey, 2002). Thus, the monopolistic member is faced to see the effect of his/her behavior on the group in an appropriate way. As another way of intervention, information could be given about the group process, it can be claimed that everyone has the right to benefit from the process and the group leader can use his/her blocking skills when needed. It must be remembered that when interfering with the monopolistic member, the aim is not to shut this member up. On the contrary, it is to make other group members know this member better by talking more shortly, briefly and deeply.

#### Questioning

During the counseling process, some group members choose to ask questions all the time in order to show that they are interested in other members or hide their feelings, thoughts and states from others. They therefore feel safe. On the other hand, some members might be seeking to give implied messages to the other members and the group leader with the questions they ask. Corey and Corey (2002) offer some examples for such questions: For instance; the member may ask the question: "How old are you?", but the implied message could be "I am older than you and I am trying to figure out if we can be in the same group.". In another example, the member can ask the question "Why do you force people this much?" s/he might mean "I am afraid that you could force me to change as well."

When working with such members, it is never sufficient for the group leader to tell the member "Do not ask questions, just make sentences about what you want to say". The group leader should explain this in an appropriate way as well as probing what is going through their minds since they might in fact giving an implied message with the questions they ask. In addition, the group leader should generate opportunities to see what other members experience with the constant questioning and to discuss how they feel about it (Corey & Corey, 2002).

#### **Giving Advice**

Another problem behavior related with excessive questioning is giving advice all the time during group counseling. The member displaying such behavior is trying to help with a behavior pattern that includes telling other group members how to perceive the situation and what to think about it and what they should and should not do about it. This could facilitate the group counseling process unless it is continuous, but if it becomes so, telling other members what to do and not to do turns into a dysfunctional situation which can lead to dependency (Corey & Corey, 2002). Considering the fact that adolescents attach great importance to their peers' advice and opinions, the member who is advised may develop such beliefs as "I should not feel like this", "I should not think this way" and could avoid sharing his/her real feelings.

Telling a member what s/he should do as a result of an event he/she shares will not chance how s/he feels. Members should also be made aware of this fact in the group (Corey & Corey, 2002). In addition, members who constantly give advice may be showing resistance, or trying to participate in the process over the member they give advice to instead of disclosing themselves. The group leader must be aware of this situation, focus on what the members feel about it and try to discover the reasons behind this behavior of the member giving advice (Corey & Corey, 2002). Thus, the member who gives advice constantly can notice how giving advice functions for himself/herself. As another way, the group leader can act as a model for the members to give feedback without giving advice.

#### **Band-Aiding**

Members who tend to band-aid try to focus on the positive sides of what is being told instead of listening to what the other members are experiencing here and now. Thus, they try to cover the distressing situation (Corey & Corey, 2002). However, it is not possible to effectively help a member whose feeling is not handled in the group. There are significant differences between being a band-aid and active listening, supporting and showing empathy. While empathy and support given through active listening enables the member to feel understood, a member whose real feeling is listened in a covered way may feel relieved at that moment, but s/he cannot feel the real support (Corey & Corey, 2002; Fehr, 2004)..

Just like constantly asking questions and giving advice, the reasons behind this behavior of the member must be probed. Standing by the member who is suffering, making him/her feel better is a very important and effective action. However, when doing this, the member should be aware of his/her motivation. The distinction should be made between the reality: Is the member saying "I cannot put up with your pain, I want to put an end to it" or is s/he really saying "I know how hard it is for you and I want to stand by you" (Corey & Corey, 2002). According to another perspective, if the member shows this behavior so as to be approved and appreciated, it needs working on (Fehr, 2004).

#### **Hostile Behavior**

A member showing hostile behavior may do so through explicit verbal messages to another group member, all group members or the leader while s/he could display this behavior by making fun or joking. In addition, such members may show their hostile behavior by arriving at the session late, being absent in sessions, expressing his/her boredom and judging other members on their feelings, thoughts and behaviors (Corey & Corey, 2002; Miller, 1996). It is usually resistance that lies under hostile behavior and the possibility to show hostile behavior particularly increases if adolescents participate in the group not willingly but being forced by others (teachers, administrators etc.) (Çakır, 2013).

Since the group leader is perceived as a symbol of authority by the members, they might display similar reactions to those they show to authority figures in the group as well. Adolescents expect the group leader to care about them on one hand, while they might want to test him/her on the other. To this end, they might exhibit challenging behavior to the leader either implicitly or explicitly (Carroll & Wiggins, 2001).

The group leader, in the first place, must avoid rejecting the member, having tough confrontation and getting into discussions with the member.

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Yet, s/he should know that over-hostile behavior is destructive for the therapeutic process of the group and shake the confidence in the group process to its foundations. This must for sure be dealt with by the leader to prevent it from disrupting the harmony and shaking the confidence to its foundations in the group. In such a case, the group leader must first act as a model through self-disclosure following the principle of "here and now". In addition, s/he should give honest, direct and intimate reactions to the member. At this point, it is highly important to be accepting, patient and willing to stand by the member. The reasons behind this behavior of the member must be focused on and one should be aware of the fact that the member may exhibit such behavior so as to protect himself/herself from something or to control the group or the leader. One way to cope with this could be to ask the member to listen quietly while others are explaining how they feel when this member acts like that. On the other hand, the member might choose this behavior as a way of expressing his/her anxiety. If it is understood that his/her fears are underlying this hostile behavior, they must be focused on and revealed (Miller, 1996).

If the hostile behavior is towards the leader, the leader must not ignore this and should definitely deal with it. S/he should appreciate the member's expression of feelings and opinions and give the message that s/he accepts them as they are to the group (Carroll & Wiggins, 2001). When a member showing hostile behavior encounters an empathetic approach, these behaviors are expected to disappear.

#### Dependency

Dependent members generally exhibit this behavior because of their sense of inadequacy. Such members try to get support other group members of the group leader through complaining about their life events, highlighting their helplessness and inadequacy or giving messages about those they are victims of. In later stages of the group process, this may turn into dependency to the group, group members or the leader (Corey & Corey, 2002).

The most basic way to help such members is not to reinforce the sense of helplessness that claim to be feeling. When they want the group leader or the members to give them advice emphasizing their inadequacy, the group leader should interrupt with questions like "Well, what's your opinion?", "What do you think of doing?", and "What's your decision?" and make the member feel that the responsibility to make decisions about their own life is left to them (Voltan-Acar, 2005; Corey & Corey, 2002). Moreover, giving feedback to these members make will help them be encouraged and gain self-confidence (Çakır, 2013).

#### **Acting Superior**

These members attempt to show they are superior to other members; they criticize and judge others. They usually utter such statements as "I used to have a similar problem to yours, but now I have no problem." However, this statement contains no support for the other member about how to cope with his/her problem (Corey & Corey, 2002).

One way of working with such members is to ask other members how the words or behaviors of the member acting superior affect other members. The members may be asked to explain what they experience or feel without judging this person (Corey & Corey, 2002). Fehr (2004) defines such people as "hard nuts to crack" and states that when other members or the group leader face this member, s/he may get aggressive and rude; trying to deny the situation. In such a case, when confronting or giving feedback, the group leader must react in a way that s/he would be a model and inform other members about how to do it and its aim before calling upon them to speak. Telling the member such things as "You compare your problems with other members' problems. Well, what does it mean to be here to you?" the group leader can make the member realize and hear once again the reasons why s/he attends and participates in the group. In addition, blocking such a member while s/he is speaking like that could be another way (Corey & Corey, 2002).

#### Socializing and Subgrouping

Socializing may increase cohesion in the group and help members support each other socially outside the group experience. However, socializing outside the group may have some negative effects on the group experience. One of these negative effects is that socializing members talk about what they want to talk outside the group, which makes them less willing to share these things during the group process. In addition, building small groups and romantic relationships among group members or friendship breakdowns may be other negative effects. Finally, socializing also brings along the possibility of disturbance of group confidence (Voltan-Acar, 2005; Corey & Corey, 2002).

In groups consisting adolescents, subgroupings are also common. In some cases, members may be divided in subgroups both inside and outside the group sessions and these groupings may reach a level that can damage the group. Members in one of the subgroups may hide some topics discussed in their own small groups or may repress themselves in order to be accepted or approved in their small groups. Members excluded from the group may feel left-out and worthless (Trotzer, 2006).

If the group leader observes any sign of destructive effect of socializ-

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ing outside the group on the group process, this should be shared with the members. Members exhibiting such behavior should be reminded that the group is a counseling group and be helped to perceive it so (Voltan-Acar, 2005). Particularly in adolescent groups, this should be handled explicitly. Otherwise, adolescent members will tend to socialize outside the group and show resistance to end the group.

#### Intellectualizing

Some group members refrain from expressing feelings about themselves and confronting them since they do not know how to express their feelings or cope with them. This may bring along talking about thoughts intensively. However, group counseling is a psychological help that focuses on members' feelings about what they experience. It is also important to talk about and deal with thoughts during group counseling. Yet, it should not be neglected that while sharing thoughts, they should be combined with feelings (Corey & Corey, 2002). One of the characteristics of adolescence is the development of abstract thoughts and idealism. Therefore, adolescent members may prefer intellectual talks and expressing the opinions they are firmly attached to instead of focusing on their feelings which have a course of ups and downs constantly. This way, they think that they can please the leader by seeming active in the group and they refrain from confronting their feelings which are hard to share as well (Trotzer, 2006).

Intellectualizing individuals should first realize what they are doing. In this situation, the leader may tell the member "You have talked about your thoughts like you usually do. Well, how did you feel about it, can you share it with us?". While working with such members, some techniques from Gestalt Therapy and psychodrama can be useful (Corey & Corey, 2002). One effective way of coping with intellectualizing is to move the focus of the group from experiences outside the group to the "here and now". Setting specific personal goals at the beginning of the group process can be useful to reduce intellectual talks in the process. In order to help the members make their sharing personal reflection, modeling and clarification skills can be employed (Trotzer, 2006).

#### Emotionalizing

Group counseling provides the members with the opportunity to experience the feelings they cannot experience other wise and to express their feelings. However, when expressing their feelings some members aim to draw others' attention. Thus, the member intensively expressing his/her feelings assumes that other members and the group leader will think s/he really devotes himself/herself to the group process. They also think that other members cannot make him/her face this way and could use this behavior as a defense mechanism (Corey & Corey, 2002).

At this point, acting responsibly, the group leader can inform the member about the group process and eliminate the member's wrong assumptions. If s/he observes that this member uses this behavior as a defense, the group leader should work on it so as not to allow the member to manipulate the situation (Corey & Corey, 2002).

In conclusion, it seems that there are several behavior problems which members could exhibit during the group counseling process. The aim of the member(s) in employing such behaviors must be revealed and intervened. This is because repeating these behaviors constantly creates chaos in the group, makes it difficult to establish emotional bonds among group members, reduces the effectiveness of the group, affects group members' attendance and may prevent the group/members from attaining their goal(s) (Corey & Corey, 2002; Corey, 2012; Çivitci 2006). On the other hand, it should be remembered that intervening effectively with these challenging behaviors during the group process is an important opportunity for the change and development of the members. In the following section, some suggestions are made for group leaders who would be leading counseling groups with adolescents.

## Effective Group Leader: Dos and Don'ts for Problem Behaviors in Group Counseling with Adolescents

Leading adolescent groups requires different strategies than those employed while working with different age groups. During the process from the establishment to the termination of the group, it is highly important that the group leader knows the characteristics of the adolescent population well and selects his/her strategies accordingly.

Similar to adult groups, member selection is significant in terms of the effectiveness of the group for adolescent groups. When selecting members for the group, the goals of the group must be consistent with those of the members. The questions "Is the group suitable for the individual?" and "Is the individual suitable for the group?" stand out as two important questions the group leader should ask himself/herself (Corey & Corey, 2002). Some adolescents are not suitable for being a member of counseling groups. Therefore, when choosing members for the group, it is critical to pick those who will not affect the group process negatively and will not be hurt during the process.

Carroll and Wiggins (2014) suggest that groups with adolescents in school environment should be established based on grade level. According to this perspective, students' social activities and behavioral expectations vary by grade level. Examining the role of gender in member selection, ho-

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mogenous gender groups are more effective in groups to be conducted with secondary school students. In this period, girls develop faster and conflicting relations are observed between girls and boys. In high school, on the other hand, holding groups with members from both genders is more effective (Corey & Corey, 2002; Carroll & Wiggins, 2001). The recommended number of members in adolescent groups is 7-8 individuals. These groups could be planned to meet during a lesson time, once every week for 10-12 weeks. Since being consistent is very important while working with adolescents, number sessions should be determined at the beginning and this plan should be applied (Carroll & Wiggins, 2001).

The group leader must have knowledge and skills about how to work with adolescents exhibiting challenging behavior, what kind of interventions to use, which interventions can help reduce these problem behaviors and which would increase them (Corey & Corey, 2002; Gans & Alonso, 1998). As mentioned before, adolescent is a period when the individual feels lonely, trying to gain independence and cope with conflicts. In groups with adolescents, many problem behaviors can be encountered which result from the nature of both the period of adolescence and group experience. Recommendations that could help group leaders to conduct group sessions with adolescents are presented as follows (Carroll & Wiggins, 2001; Corey & Corey, 2002; Everall & Paulson, 2002; Freake, Barley, & Kent, 2007; McMurray, 1992).

• Be careful to make an effective and detailed structuring at the beginning stage of the group. Set the group rules clearly. Provide information about what can be spoken in the group and encourage the members to share their feelings. Emphasize the importance of being honest to themselves and their group mates.

• Adolescents frequently test the group leader's honesty in his/her words and whether they could trust him/her. When faced with such a situation, the leader must not be defensive and judgmental and avoid speaking in an advising or didactic manner. Being natural and spontaneous is a characteristic that a counselor working with adolescents must definitely have as adolescents are successful in noticing the leader's affectation immediately.

• In some counseling groups conducted in schools, adolescents sometimes participate as a result of their teachers' or families' referral, but not willingly. In such cases, it would be useful to come together individually with the student, talk about the situation, explain the goals of the group and discuss the negative attitudes, if any, of the member towards the process. It is suggested that the member's resistance be not fought against and tried to be understood during the group process.

• Group leaders working with adolescents could often experience

role conflicts about "being one of them" and "being the authority figure". The group leader must not try to act as if s/he is one of them just to be accepted by his/her adolescent clients. For example, since such attempts as speaking like them would be perceived unnatural, they could bring about damage rather than benefit. On the other hand, acting like an authority figure, prioritizing the role of the teacher and being over directive will disrupt the formation of confidence in the group. As a leader, not using your power to control the adolescents, guide and repress them will usually be enough for them to feel respect and trust for you.

• At the initial stages of the group, it is expected that the members dive too many details and tell long stories. Asking how the member was affected by the event s/he told about is an effective way to be applied in order to take the focus to here and now.

• In adolescent groups, such behavior as giggling, poking each other and whispering can be exhibited. When such behavior starts to be frequently repeated, the leader may choose to sit between the persons behaving this way. S/he may speak his/her feelings about this situation clearly with the group or if they are exhibited by certain members, these persons may be seen individually.

• Adolescents expect the group leader to treat them as real individuals. Not being despised or treated like children make them feel important. Therefore, it is necessary that group leaders respect the adolescent group members' truths, build egalitarian relationships and let them take personal responsibility.

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## DEVELOPMENT OF FRACTION CONCEPTS IN CHILDREN

Cahit AYTEKİN<sup>1</sup>

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If the student does not ask why or is blocked by the teacher, it means that the people who can produce information in this society are blocked.

#### Introduction

In this introduction section, the structure of natural numbers and fractions will be examined in the transition to teaching the concept of fraction. The difficulties of natural numbers will be mentioned in the teaching of the concept of fraction. The skill of "expressing equal parts according to the whole" will be mentioned and the importance of equal sharing activities will be emphasized. Useful information from the literature will be given about equal sharing activities.

Teaching continuous structure of fractions after teaching natural numbers

The first seeds of the concept of fraction are planted by noticing the daily life situations that do not fit the discrete structure of the natural numbers. Therefore, it may be useful to leave the children alone with the problems like "half-way man problem" that will allow them to feel continuity.



#### Figure 1. Modelling of half-way man problem

In Figure 1, a passenger will travel a certain distance. First half of the way it will go; then the remaining half; then half of the rest; that is, he walks half the way he goes every day. Students are asked how many days the man will reach his destination. The man can never reach because there is always a length to go. Every time he has to go half the remaining road. A new point can be found between the two points in the number line. However, this does not apply to natural numbers. For example, the shots in basketball are 1 point, 2 points and 3 points. No matter who it is, it should either get 1 point, 2 points, 3 points or no points from a shot. No basketball player got 1.5 points. Discrete and distinct structures can go to infinity. But these structures cannot be divided into infinite parts. If we consider the counting numbers, 2 comes immediately after 1 and continues forever. But there is no other number between 2 and 3. In the word discrete, I mean that the next one comes immediately after one and there is nothing between the two numbers. In their study, Ni and Zhou (2005) claim that one of the most important problems in teaching fraction is that children try to understand fractions on the basis of the natural number logic.

## Difficulties of Natural Numbers in Teaching the Concept of Fraction

Many educators think that one of the sources of the problems children experience while learning fractions is trying to understand fractions with the information they obtain from natural numbers. Ni and Zhou (2005) provided three different explanations about the source of students' tendencies towards natural numbers. The first is the question of whether the schemes created by the students about the discontinuous number system of natural numbers are innate. This situation can be explained by the following hypothesis. The schemes in the child's mind develop from discontinuous to continuous. In this respect, it can be said that students who try to understand fractions with their natural number schemes cannot create a continuous number system. In the second explanation, the approaches used when teaching fractions were evaluated. The issue discussed here is whether the mind's determination in pre-learning hinders the flexibility required for new learning. Ni and Zhou (2005) argued that starting fraction teaching using by sharing or measurement activities supports the cognitive flexibility required for effective and meaningful fraction teaching. They emphasized that the flexible thinking ability of the students should not be blunted. The third explanation is that the relationship between different forms of representation of a fraction cannot be established. This leads students to understand fractions on the basis of natural numbers. A study by Ni (2001) deals with different forms of representation of the same fraction. The different performances of the students in this research constitute an important proof for this explanation. Identifying the forms of representation that children used on natural numbers in the early days can be an important resource. Recent studies on the brain provide us with important information on symbolization, visual representation in the mind, and language and speech. But this is not so easy. Studies on development can provide important information to understand the infrastructure of children's schemes from discontinuous to continuous development. Useful information can be obtained if studies about methods used in fraction teaching are examined. Neurophysiological learning theory has the potential to explain how fraction teaching should be.

A tendency towards natural numbers in learning fractions manifests itself especially in "part-whole" activities. There is a tendency for all children to divide the whole into equal parts and count the parts with natural numbers such as 1, 2, 3. I think that the tendency to count in this way has a negative effect on gaining the continuous meaning of the fraction concept. Children often refer to counting schemes in natural numbers when learning fractions. This situation may lead to the misconception that natural numbers are in a continuous structure. Because many children who say that 1/3

is less than 1/4 suggest that four is bigger than three. The fact that the children say that the result is 2/5 when adding 1/3 to 1/2 shows that they mixed the concept of fraction with natural numbers. For example, there are many students who do not see 1/3 as a single number. Most of the children say that there are two numbers in 1/3 fraction. There are students who say that there is no other number between the numbers one and two. All these troubles arise from trying to understand fractions on the basis of natural number schemes. These types of problems are also manifested in fractions such as division and multiplication. Many children cannot understand why the result of dividing two fractions is greater than these two fractions. Because in the division operations in natural numbers, children have seen that the result of the division is either equal to or smaller than the dividing number. In fractions, different situations can arise. This varies according to the magnitude of the values of both fractions. According to Pitkethly and Hunting (1996), the source of the difficulties children experience is that fractions are not a natural number and arise as a result of the evolution of human needs. Filep (2001) stated that there are great similarities between the process of learning fractions of children and the development of fractions in human history. While teaching the concept of fraction, we should provide children with appropriate problem situations and learning environments in order to achieve this development, just as human beings have reached fractions. At this point, it would be beneficial to consider students' expectations and needs in order to organize learning-teaching activities (Sarıca, 2020).

#### **Equal Sharing Activities**

The teaching of fractions should be emphasized firstly on the activities of being equal and dividing the whole into equal parts (Baykul, 2003). It may be useful to divide a notebook sheet into equal parts and ask if the parts are equal. It is also useful to explain to students why it is equal or not. However, it may also be useful to take another sheet of paper and divide it into unequal pieces and emphasize that they are unmatched by overlap. Equal sharing activities with different shapes and forms of representation can provide a good basis for further learning. It can be recommended as a useful activity for students to distinguish between those who are shared equally with activities such as below.





*Figure 2. Possible shapes that can be used to comprehend equal sharing (Baykul, 2003)* 

#### **Re-Expression of Equal Parts According to the Whole**

Fraction can be seen as dividing a whole into equal parts and expressing a certain part of these parts by comparing them according to the whole. For this reason, activities based on equal sharing and expressing the whole are very useful (Baykul, 2003).



*Figure 3. Activities expressing equal shares according to the whole (Baykul, 2003).* 

Studies similar to the above activities can also be done in other formats divided into different numbers such as three, four, five, eight and ten. It should be emphasized that some of the shapes in Figure 2 are separated unequal parts, that such ones will not form fractions and should be discussed in the class.

#### Literature on Equal Sharing

Children face the situation of sharing many things equally with other people before starting school. Many preschool children even face "long division" situations. In a study conducted by Baba and Iwasakai (2004) in Japan, only one of the 5-year-old children was found successful in equal division activities. The researchers showed 5 years old preschool children some sugar and asked them to divide it into two, three and four. Equal division situations are very important in teaching fractions. Therefore, this issue should be given more importance in pre-school and first years of primary education. Equal sharing problems in the first years introduce children to the different thinking aspects of partitioning. The child to share equally has to coordinate the number of parts, the number of people and their relationship with the whole. Disproportionate sharing activities and getting half or a quarter are not the same (Empson, 1999). We need to create learning environments that involve equal sharing activities that preschool children will need fractions. Let's consider two situations as follows, where a preschool child lives.

Case 1: Ayşe wants to share 17 marbles to her four friends.

Case 2: Ali wants to share 17 cups of flour to his four friends. (Toluk, 1999)

The first of the above examples is the "long division". The child cannot divide the last marble into four equal parts and distribute it to her friends. Even if he smashed the last marble, it will no longer work. In the second case, there is a situation where it can share the rest. After giving every-one four glasses of flour, the flour in a remaining glass can be distributed evenly by giving everyone a quarter glass. In their study, Behr and Post (1988) found that children's skills in addition, subtraction, multiplication and division activities in integers form constitute a basis for understanding other meanings of fractions. Saenz Ludlow (1994) stated that children have difficulty in perceiving fraction as a single number. For these children, he suggested that some activities should be included to grasp fractions as a plurality before symbolizing fractions. In this context, support and training courses, which are stated to be a good learning environment for students in the education system of our country (Sarıca, 2018) can be used for extra activities.

Vygotsky (1987) thinks that a concept has two forms. One of them is the meaning of the concept in daily life and the other is its scientific meaning. According to Vygotsky, the meaning in daily life has no systematic structure. This can sometimes lead to misunderstanding of scientific concepts. In a meeting with a child in Japan, when the child was asked what "half" meant, the boy replied that something was shared equally by three people. The source of this idea is that when he hears every half word, the child comes to mind to share a chocolate with his two siblings. Since the child shared it with two people, it meant dividing the half into three equal parts. From this situation, we conclude that the development of the fraction concept may occur as a result of a systematic education from pre-school.

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We can say that equal sharing provides a basis not only for the concept of fraction but also for learning other concepts. In his studies, Olkun (1999) revealed that the meaningfulness of the volume formula to students depends on being able to imagine dividing a cube into equal units. In a primary school in Japan, it was observed that students were introduced to the subject of fractions in the third grade of primary education for five days. As a result of this observation, it was determined that many of them experienced difficulties due to lack of information about equal sharing and division. In order to overcome this, the teacher of the school had to include activities such as equal sharing, segmentation, half and quarter (Yoshida, 2004). Streefland (1991,1993) examined the fractional development of 13 fourth grade students for two years. He concluded that equal sharing activities are directly related to the meaning of rational numbers. With such activities, it has been observed that children create their own fraction schemes more easily. It is observed that students with equal sharing experience develop the concept of fraction more easily and can easily apply this information to problems. Below we see one of the questions Streefland asked.

His mother, father, Ann and Peter bought two pizzas for dinner. The first pizza was shared equally. The mother, who divided the second into four equal parts, turned to the others, and the first piece I ate was enough for me. You share these pieces with three people. Ann says that one of these four pieces is enough for me and leaves the rest to her father and brother. Find the amount of pizza each person eats (Streefland 1993, page 294).

Students were assigned tasks by Davydov and Tsvetkovich (1991), especially on the meaning of measuring equal sharing. Thus, schemes about the unit fraction of the children were developed. One of these tasks is given below.

Some water was given to the students. They were asked to measure the amount of water here with two glasses, one twice the other. During the measurement, it was counted how many small glasses or how many large glasses they could complete this water. Then these two questions were asked. Why did we measure larger with the small glass, how many glasses were more filled? What is the relationship between these two measurements?

Pothier and Swada (1983) concluded from their studies with children from kindergarten to grade 3 that there are 5 basic levels in children's ability to divide into equal parts. The students at the first level use the sharing strategy by using half-taking mechanism while the second level use the strategy by taking the multiples of 2 (double mechanism) algorithmically. At the third level, the child becomes able to express the concept of a couple and express the fractions with an even number of denominators. The

fourth level is stated as expressing fractions whose odd denominato. At the fifth level, the student can see the relationship between the exponential odd numbers and equal sharing. For example, the student, who realized that it is necessary to divide the region divided into three equal parts again into three to produce 9 equal parts, is at the fifth level. In the research carried out by Pesen (2008), it was determined that the 3rd grade elementary school students had difficulty in dividing a whole on the number line into equal parts. Some of the students have difficulty in perceiving the a / b fraction as one number. Students in this situation perceive the numerator and denominator as if they are different numbers. While some of the students divide the whole of the number into equal parts, it was also found that they found a missing piece because they counted only the points. According to this research, 59% of students could not show a fraction on the number line. When the literature in fraction teaching is examined, it can be said that equal sharing activities play a key role in effective and meaningful teaching. In this context, concept maps, which have an important place in concept teaching and provide meaningful learning (Sarica & Cetin, 2012) can also be used to reveal students' misconceptions about the subject and also can be an enjoyful activity for children.

#### **Different Meanings of Fractions**

#### **Fractions As Parts of a Whole**

The whole meaning of fractions is an important basis for the development of other meanings. Equal sharing is the basis of the meaning of the part-whole. Children face some difficulties while developing the partwhole meaning of fractions. These difficulties are especially about what the whole will be. For example, finding 2/3 of one cake and 2/3 of three cakes is not the same. The whole 2/3 fraction in both is different. Understanding this relative situation is very important for understanding other meanings of fractions (Toluk, 1999). There are some suggestions for children to improve their part-whole meaning. First of all, children should know that the parts are formed by dividing the whole into equal parts. However, they should be able to divide a given region or some number into equal parts. Children should have a good understanding of the relationships between parts and the whole. The first of these relationships is the totality of the parts. The second is that the more pieces are divided into whole, the smaller the size of the pieces. Children who do not know that b is the number of pieces that the whole should divide in a/b representation of fractions often make mistakes in fractions. These children can show the shape that represents 2/5 for the 2/3 fraction. Batura (2004) stated that the full understanding of the parts-whole meaning of the children depends on dividing them into units and re-dividing the parts they divide into units.

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Only in this way, students can divide 3/4 into units again and show 3/8 units. In order to make students understand these relationships, it may be useful to ask questions in the following structure.

> If the candies below represent 2/3 of some sugar, draw the total amount of sugar (Batura, 2004).

▶ Which of the following represents 2/3 fraction?



The most difficult situation in the meaning of parts-whole is when the denominator is larger than the denominator. Because if a shape is divided into equal parts and some or all of these parts are taken, the denominator must be less than or equal to the denominator. It is useful to design learning activities involving the following problems during the acquisition of the part-whole meaning.

> Ahmet and Ayşe have two chocolate bars of the same size. Ahmet divides his chocolate in half and eats one while Ayşe divides his chocolate in four and eats one for every two pieces. Did Ahmet eat more, the same, or less chocolate than his friend Ayşe?

Ahmet and Ayşe both have one chocolate. Ahmet divides his chocolate into 2 pieces and eats one piece, while Ayşe eats 3 pieces and eats one piece. Which would have eaten more chocolate?

> It is taught that 1/2 a fraction is divided into two parts of a whole and take a part of it. Then one can ask how to divide one bread into three equal parts and show eating one.

#### **Division Meaning of Fractions**

The a/b fraction represents the separation of "a" elements into "b" groups. Here, "a" refers to the number to be divided, and "b" refers to the number of groups. In this sense, the numerator may be greater than or equal to the denominator. Children who grasp the meaning of division in fractions can easily make sense of when the numerator is larger than the denominator. This meaning of fractions is different from the part-whole relationship. Below is the reaction of a 5th grade student in Arizona who sees a fraction that its numerator larger than its denominator.

Student: Now I will show you the fraction 5/2. Can you tell me what this means?
Researcher: Bad fraction.

Student: What do you mean when you say bad fraction?

Researcher: Because it's bigger than two.

Student: Why do you think this fraction is bad?

Researcher: Because the top number is bigger than the bottom one.

Student: So what makes this fraction bad?

Researcher: It's hard.

Student: Why is it difficult?

Researcher: It's difficult to understand fraction. (Toluk, 2002)

In order to gain the meaning of division, learning activities including the following problems can be done.

I. In the first group, 2 people have one chocolate to share and in the second group, 4 people have 2 chocolate to share. In which group does a person eat more chocolate?

II. There are two people in the first group and three in the other. If each group shares one chocolate equally, in which group would the person eat more chocolate?

III. After teaching that 1/2 fraction refers to the sharing of one chocolate by two people, it can be asked how one chocolate can be shared by three people (Mamede, Nunes and Bryant; 2005).

#### **Measurement Meaning of Fractions**

Children find it difficult to grasp that the fractions show either a point or a distance on the number line. The 1/b fraction shows parts that are divided into "b" parts. How many of these pieces we have means that we show our place in the number line. We can describe the distance we want with 1/b long pieces. It is very important to realize that 1/b pieces can be used as a measuring tool. The a / b fraction actually symbolizes "a times progression" from standard pieces of 1 / b length. The concept of equal sharing also forms the basis of this measurement meaning of fractions. Streefland (1991) mentioned that it is very important to establish a logical relationship between the interpretations of equal sharing and the different meanings of fractions.

#### **Ratio Meaning of Fractions**

The concept of ratio is a comparison of two multiplicities. More specifically, it shows the relationship between the two sizes. This meaning

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of fractions cannot be perceived as parts-whole. It is a comparison of one quantity with another. Let's say we throw three white balls for both red balls we put in a box. So we'll have to throw 30 white balls for 20 red balls. The number "a" in a / b fraction here is not part of "b". In the example above, we compared red balls to white balls. The ratio of red balls to the number of white balls as fractions is 2/3. If we compared the ratio of white balls to the number of red balls, it would be 3/2. If we compare the total number of balls with white balls, it will be 3/5. Proportioning according to the whole also means part-whole meaning. This meaning of fractions only occurs if we make the comparison according to the whole. The ratio meaning of fractions is a comparison indicator. Lamon (1999) states that comparing similar types of quantities and comparing different types of quantities should be considered and understood as different concepts. Lamon explains this issue by showing two students who solve the following problem with different strategies. In the question, 7 girls share 3 pizzas among themselves while 3 boys share 1 pizza among themselves. Students need to find out whether a boy or a girl ate more pizza. If the student compares the number of children with the number of pizzas, he used the concept of different types of proportions. However, if the students compare "ratio of the number of girls to boys" with "ratio of pizza numbers", they are using the concept of similar type. A full understanding of the concept of proportion in fractions depends on making sense of the meaning of the relationship between the two things. This is based on the relationship between varying amounts that are linked together. Finally, it should be noted that if both the quantities compared are multiplied by a number other than zero, the ratio does not change. This situation in terms of ratio of fractions completely separates it from the whole meaning of the piece. In addition, understanding this situation in fractions can be seen as an aid to understanding equivalent fractions. However, according to Lamon (1999), this is not an indispensable qualification for the equivalent fraction scheme. The question of orange juice, written by Noelting (1978), is often used to measure whether students understand the meaning of ratio and proportion.

John and Marry together are preparing orange juice for their party. Below are the orange juice recipes they use. Which of them do you think, the orange juice created by the recipe is more dense in terms of the amount of orange?

John's Recipe: 2 glasses of orange flavor for 5 glasses of water Marry's Recipe: 4 glasses of orange flavor for 8 glasses of water

Students' understanding of the concepts of distance, speed and time depends on understanding this meaning of fractions.

### **Operation Meaning of Fraction**

Fractions can be used as a function to convert a number. We can think of this meaning of rational numbers, for example, as a function machine that converts every 6 objects to 5 for fraction 5/6 (Behr, Lesh, Post, Silver E. 1983).

**Shrink Function**: For example, let's use the fraction 5/6 as a function for the number 18. Let's convert every 6 of the following multiplicities to 5.



**Enlarging Function:** Let's use 7/6 fraction as a magnifying function for the number 18. Let's convert every 6 of the following multiplications to 7.



The following question was asked by Lamon (1999) to determine whether the fractions' function meaning is gained. The figure below represents a machine that gives out 2/3 of every quantity thrown in. If 12 is thrown in, which number will come out?



Figure 4. Fractions' function machine

#### Literature on Different Meanings of Fractions

Understanding different meanings of fractions requires different mental processes. Equal sharing concept is the basis of all of the meanings of function, measurement, ratio, piece whole and division. Kieren (1976) thinks that in order to gain the concept of rational number, it is not enough to know every meaning of fractions, and the relationship between these



different meanings must be established. For this reason, performing equal sharing activities in preschool age provides children with convenience at a later age.



Figure 5. The relationship between different meanings of fractions (Behr, Lesh, Post ve Silver, 1983)

Kieren (1976) suggested that four sub-concepts must first be developed for the development of fractions. The main reason why he avoided putting forward the part-whole meaning was that this meaning of fractions existed in all four sub-concepts. In order to fully acquire the concept of fraction, it is necessary to understand these four concepts and understand the relationships. Later, Behr (1983) and his friends suggested the meaning of the part-whole as a different meaning. They also relate the meaning of the part-whole to the partitioning process. In addition, they formed the above diagram between different interpretations of fractions, fraction operations and problem solving. According to the above diagram, the partwhole meaning of fractions constitutes a basis for the other four meanings. This situation explains very well in the curriculum of many countries that a lot of time is allocated for the part-whole meaning of fractions and that the teaching fraction is started with this interpretation (Batura 2004). The ratio meaning of fractions was seen as the most natural way to teach equivalent fractions. Function meaning of fraction is very useful for teaching multiplication in fractions. Measurement meaning of fractions requires consecutive addition, since it can be used when processing addition in fractions. Finally, these five interrelated and different meanings of fractions are necessary for the solution of fraction problems.

In order to fully develop the concept of fraction, it is necessary to work with the representations of fractions in different forms. Different representation formats with area, number line, and some objects are commonly used to represent fractions. These forms differ from each other both in appearance and in terms of emphasizing different aspects of a fraction. Research has revealed that these different forms of representation lead different mental processes in terms of students' use of unit fractions (Toluk 2009).



Figure 6. Fraction wall activity (Pearn, 2007)

Pearn (2007) taught children between the ages of 5 and 8 with different meanings of paper folding, fraction walls and number lines and fractions. Thanks to these activities, students have made significant connections between the symbols and operations of fractions and their meaning in daily life. A fraction wall used in these events is seen above.

#### Four Operations in Fractions

#### The Importance of Unit Fraction Concept

Lamon (1996) states that children have difficulty in developing the concept of fraction because they realize the importance of unit fraction later. The child must see that the unit fraction in different situations also has different meanings. We need to allow the child to add up using unit fractions. It may be useful to produce questions that the child must find the unit fraction of himself, but also use it. The teaching of the unit fraction corresponds to the third grade of primary education in Turkey. Below we see an activity prepared on unit fractions on 3rd grade workbook written by Eden (2009).



Figure 7. Unit fraction activities for 3th grade students (Eden, 2009)

### The Importance of Equivalent Fraction Concept

In many and even some textbooks, we try to be taught based on the rules with the expression "the numerator and denominator of a fraction is multiplied or divided by the same number" to obtain equivalent fractions. Such an approach leads students to mechanically find the fractions, not to apply what they have learned to new situations and to solve problems because they do not understand the concepts. Instead, a teaching based on understanding the concepts should be preferred. Meaningful teaching can be carried out based on the concepts of fraction, unit fraction and relationships between them (Baykul; 2002). The reason for giving so much importance to teaching the concept of equivalent fraction is that this concept will be used both when ordering fractions and when subtracting, multiplying and dividing. The following activities can be done to gain this concept.

 $\succ$  Doubling one of the two notebook pages, the other in four. Then paint one part from the first, paint two parts from the second.



Figure 8. Representation of fractions 1/2 and 2/4

> After examining the above figures, asking questions like "these two fractions are the same? Why? Since these figures are the same, what can we say about the fraction numbers they indicate? How do we write them?



Figure 9. Representation of 1/3, 2/6 and 4/12 equivalent fractions

In order to fully develop the concept of fraction, it is necessary to work with the representations of fractions in different forms. Representaion formats with area, number line, and some objects are commonly used to represent fractions. These forms, which are used to represent fractions, differ from each other both in appearance and in different meanings. Research has revealed that these different forms of representation lead different mental processes in terms of students' use of unit fractions (Toluk 2009). Below we see the number line and cluster formats related to the equivalent fraction.



Figure 11. Representation of equivalent fractions as a set type.

#### **Addition in Fractions**

Giving the rule without any activity for addition and subtraction in fractions can lead to difficult misconceptions. As a result of teaching with this approach, even in the level of university, there are students who do not know the meaning of the rules used when adding fractions. Maybe they may seem to do mechanical operations on fractions properly. But they will not be able to use what they have learned elsewhere where they need to transfer. Instead of giving the rule and performing the procedure, applying an approach that will enable students to comprehend the meaning of the processing technique leads to more effective learning (Baykul, 2002).



*Figure 12. Showing 2/4 and 1/4 sum by model* When doing addition for "fractions with different denominators" it is



important to use equivalent fractions and unit fractions. For this, it may be useful to fold, paint, partitioning and adjoining activities that include the following models. Modeling activities like this are very important for developing a meaningful and effective addition skill.



Figure 13. Showing 1/2 and 1/4 sum by model

#### **Misconceptions about Addition in Fractions**

The most common misconception about adding in fractions is to collect the numerators and denominators. The biggest reason behind this error is that students try to understand fractions with natural number schemes. The thought of a student who made a mistake in this way is modeled below.



Figure 14. Cluster representation that creates misconceptions about addition in fraction

Other causes of misconceptions in fractions are not using unit fractions and equivalent fractions. However, when the meaning of addition in the fractions is not mentioned, such mistakes are observed in the students.

#### **Subtraction in fractions**

When modeling subtraction in fractions, it is necessary to focus on unit fractions and equivalent fractions. In subtracting fractions with different denominators, making sense through the concept of equivalent fraction becomes an effective teaching.



Figure 15. A modeling for subtracting fractions with equal denominators

It should be emphasized that while fractions with unequal denominators are taught to be subtracted, the fractions are expressed according to the whole of an equal size.



Figure 16. A modeling for subtracting 3/8 from 1/2

#### **Misconceptions about Subtraction in Fractions**

In a study by Toluk (2009), the answer given below by a pre-service teacher who was asked to create a model for the 3/4 - 1/2 operation in a study by Toluk (2009).



Figure 17. Incorrect modeling to subtract 1/2 fraction from fraction 3/4 (Toluk, 2009)

## **Multiplication in Fractions**

In the teaching multiplication process in fractions, it must be started by multiplying a fraction with a natural number. Then the multiplication of two proper fractions can be addressed. It can be continued by multiplying two compound fractions. Finally, arranging activities related to multiplying two mixed fractions makes learning easier (Baykul, 2002).





Figure 18. Visualization of the multiplication of 2/5 and 2/7

In a study on prospective teachers by Toluk (2009) below, we see an accurate modeling of the process of a teacher candidate taking a mathematics teaching course.



Figure 19. A modeling of the multiplication of 3/4 and 1/3 (Toluk, 2009)

#### **Misconceptions about Multiplication in Fractions**

Multiplication in fractions is different from the multiplication in natural numbers. Students tend to interpret multiplication in fractions as in natural numbers. Therefore, misconceptions begin to occur. In multiplication of natural numbers, if it is not multiplied by zero, the result is never smaller than the number multiplied. In multiplication with fractions, activities related to taking a certain part of a fraction should be done. It will be very useful to show them on the model. Unfortunately, like any other subject, only the rule is given, then a lot of routine problems are solved. The meaning of multiplication in fractions is not mentioned. As a result of such an education, students who do not like mathematics, cannot apply what they learn to new situations and cannot solve problems. Below we see how a pre-service teacher modeled multiplication in fractions before taking a mathematics teaching course.

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Figure 20. An incorrect modeling about multiplication in fractions (Toluk, 2009).

### **Division in Fractions**

Most mathematics books do not focus on the meaning of division in fractions. Instead, the focus is on how to make the inverse and multiplication algorithm mechanically. This causes the division in fraction to be not understood. For this reason, students find it difficult to solve division problems in fractions (Baykul, 2002). Dividing in fractions is not different from dividing in natural numbers in terms of meaning. Activities for the meaning of division in natural numbers can be carried out at the beginning of the division teaching activities in fractions.

- I. How many three are in number 18?
- II. How many quarters (1/4) are there in a 3/2?

In the teaching of division by fractions, activities should first be made on the division of a fraction by a natural number. Then, activities related to the division of the two fractions should be started (Baykul, 2002). Including simple, compound and mixed fractions is important for consolidating the concept of division in fractions.





A prospective teacher taking the mathematics teaching course was asked to produce and model daily life problems for the 2/3: 1/2 procedure. The teacher candidate said, "It is desired to fill half-liter bins with one-liter container with 2/3 of which is full, and, how many bins are filled?". Getting students to such a high level of thinking is not an easy. However, as long as we do not change our teaching method, many students in our education system will be trained without being deprived of the beauty of mathematics. Unfortunately, our students will not be able to get rid of being individuals who can not only produce what they are routinely repeating. In a study conducted with pre-service mathematics teachers, it is stated that pre-service teachers think that they learn more easily with the traditional method and that they may be reluctant from time to time regarding the new learning-teaching methods and activities (Sarıca, 2016). For this reason, it may be more beneficial to have our mathematics teacher candidates gain experience by different methods and meaningful learning at an earlier age and in their own education.





*Figure 22. An example of correct modeling for 2/3 : 1/2 operation (Toluk-Uçar, 2009)* 

After the above activities are made, of course it is necessary to ask questions that explore the algorithm of the process. However, without knowing the logic of the invert and multiply algorithm, it is not correct to apply the invert and multiply rule mechanically. It causes students to view mathematics as a lesson they do without knowing the meaning of nonsense rules.

#### **Misconceptions About Division In Fractions**

The concept of division in fractions is an unknown concept for many prospective teachers, even experienced teachers. If a concept is not known at all, there will be no misconception about it. The number of teachers who organize and apply activities on division in fractions is very rare. Students who practice mathematical procedures in the same way are considered successful according to many the education systems. However, for individuals who question and produce, teachers should not be able to memorize algorithms, but rather provide students with an environment to create such rules. Below we see some opinions of prospective teachers studying in the teaching department of the faculty of education.

I thought I knew fractions. But in this course, I learned that knowing how fractions are calculated is not enough to teach fractions. It is necessary to know more than that to teach fractions. Now I know better. It is still not easy for me to explain division in fractions.

After this last test, I realized that what I know about fractions is just the rules I remember. Now I'm more comfortable. I can explain many things about this subject.

I thought I knew a lot about fractions, this period I prepared a lesson plan about multiplication in fractions, I think I'm not very good at it.

(Toluk-Uçar, 2009).

We see the answer given by a pre-service teacher who is asked to form a model about division in fractions.

This is ridiculous! I cannot create a model for division in fractions. I don't think anyone can do this. We only use the rules for this process. I

think this is very confusing.



*Figure 23. A teacher candidate who cannot do modeling for 2/3: 1/2 operation turns to the inverse multiplication algorithm (Toluk-Uçar, 2009)* 

**Discussion and Suggestions** 

In line with the research on fraction development in children Primary Mathematics Program Turkey (Meb. 2009; Meb. 2017) started with equal sharing activities. Achievements on equal sharing, including concepts such as half, whole and quarter, continue until the third grade. In the third year, a trend is seen from equal sharing to a unit fraction. In the fourth grade, there are objectives related to the skill of comparison, which requires the active use of the unit fraction. I think the most critical year in fraction development is 4th grade. Because in the first three classes, there are such activities such as half a quarter and equal allocation. If the child cannot explain the ordering and addition operations in the 4th grade by using what they have learned up to the first three grades, the connection cannot be fully achieved. It is also a known fact that ordering, addition and subtraction of fractions are taught based on memorized rules only. The objectives related to equal sharing are not suitable for teaching based on memorization and algorithm teaching. Especially after the fourth grade, there is a tendency towards rule-based education such as "the fraction with small denominator is larger". Therefore, only an in-service training course on fraction teaching can be given to 4th and 5th grade teachers. In addition, rule-based teaching of fraction operations in these years causes students to dislike mathematics. In addition, the wide-ranging standard tests applied in our country and their results triggers negative feelings like anxiety, stress, boredom, etc. that students experienced (Sarıca, 2019) and this situation also affects students' interests and motivations for lessons.

There is a need for individuals who think, question and produce for our age societies. Today, the society that produces information is one step ahead of other societies. So it is necessary to have the idea of creating that computer first, not knowing how to use a computer, repairing it, or producing its parts. The feature that exists in all of the people producing knowledge is the ability of critical thinking. In a society where rules are given and memorized by students, individuals cannot be trained to think critically. When the student solves the question in a different way, it has very negative consequences if it is not supported by the teacher. For example, when the teacher says "When adding fractions, the denominators

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need to be equal then the tops are added," the students should ask why? If the student does not ask why or is blocked by the teacher, it means that the people who can produce information in this society are blocked. It is very grave that people who teach mathematics see mathematics as a set of rules that have no relationship with nature.

When the development of all concepts within the history of mankind is observed, it is seen that it is parallel with the development of the child. It is impossible for children to develop these concepts on their own in a few years. At this point, the task of the teacher is to ask appropriate questions and create learning environments that will enable the student to understand of this concepts and rules. The subject of fraction is not a closed subject. and it paves the way for the development of a meaningful rational number concept in the coming years. It is also the basis for many areas such as ratio, division, function, linear algebra, geometry and probability. Therefore, children need to experience mental processes related to all the meanings of fractions and engage in different forms of representation. It should be ensured that teacher candidates are conscious of these issues. Extensive research on the fractions of countries and revealing current situation may guide the measures to be taken. Among these measures, it can be said that new academics will be trained to work and guide in this field. In addition, it is important to educate prospective teachers in this direction.

Traditional methods are insufficient to meet the changing needs of today's students and therefore learning-teaching methods also differ (Özbay and Sarıca, 2019). For this reason, we should train our teacher candidates to use different technologies and methods. Meaningful mathematics teaching should be emphasized in in-service training programs to be applied to teachers. I wouldn't have believed if they had said that someone who graduated from university might have a deficiency in fraction. Acquisition of a concept does not mean routine operations related to it. Our schools are not places to transfer stereotypes to students, but to discover, gain and produce life.

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# EXAMINING THE EFFECTIVENESS OF AN AUTONOMY SUPPORT TRAINING PROGRAM BASED ON SELF-DETERMINATION THEORY: A MIXED MODEL STUDY

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Self Determination Theory is a motivation theory based on principles derived from various controlled empirical studies (Deci & Ryan, 2008). The theory posits that humans are innately prone to learn, develop, orient themselves with cultural values and build fulfilling relations with their environment (Keltner, 2009). The theory suggests a distinction between the "self-determination based" and "control-based" types of regulation. Motivated behaviors are named as "self-determined" up to the point they are voluntarily acted and "controlled" if they are realized as a result of external constraints (Deci, Vallerand, Pelletier, & Ryan, 1991). Within this context, the educational outcomes of the theory reveal that teachers can accomplish a motivating teaching style by creating a good structured and autonomy supportive educational environment and interacting with their students in a warm and compassionate fashion (Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014). On the contrary, the controlled, chaotic and inadequately involved teaching style leads to need thwarting and diminished student motivation (Deci & Ryan, 2000).

Research has shown that a great amount of teachers are more prone to applying control-based methods (e.g. punishment and reward) than embracing an autonomy supportive style (Newby, 1991). Moreover, many teachers do not have adequate knowledge about autonomy support, whereas some of them revealed that they have not even heard of the concept (Reeve, Jang, Carrell, Jeon & Barch, 2004).

#### **Autonomy Support**

According to Self-Determination Theory, autonomy supporting environment provides the person with options and encourages them to behave with freewill, facilitates internalizing values and behaving through intrinsic motivation (Kındap, 2011). The autonomy supportive style in educational environment includes defining and nurturing the intrinsic motivation sources (interests, options and personal goals) of students and promoting an internal locus of causality (Reeve, 2009). It helps teachers understand the point of view and feelings of their students (Deci, Eghrari, Patrick, & Leone, 1994), providing them with a meaningful rationale (Aelterman et al., 2014; Assor, Kaplan, & Roth, 2002) and present interesting and important learning activities that uncover their willingness (Cheon, Reeve, & Moon, 2012; Cheon & Reeve, 2013; Jang, Reeve & Deci, 2010). Otherwise, students may perceive the controlling behaviors (deadlines, commands etc.) of their teachers as pressure or coercion and accordingly feel themselves as "pawns" in their hands (Skinner & Edge, 2002). Teachers can provide their students with autonomy support by creating opportunities for self directing educational activities (Deci, Spiegel, Ryan, Koestner, & Kuffman, 1982; Jang, Reeve, & Halusic, 2016; Nix, Ryan, Manly, & Deci, 1999; Reeve & Cheon, 2014; Reeve & Jang, 2006).

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A great amount of research based on SDT reveal that autonomy supportive style of teachers increase the motivation, self-regulation, engagement, learning, achievement and psychological well-being levels of students (Cheon et al., 2012; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). This assumption has been proved in various education degrees including nursery (Koestner, Ryan, Bernieri, & Holt, 1984), elementary (Deci, Nezlek, & Sheinman, 1981, Grolnick & Rvan, 1989), secondary (Vansteenkiste et al., 2005), high school (Reeve et al., 2004), college (Black & Deci, 2000; Vallerand & Bissonnette, 1992), postgraduate (Williams & Deci, 1996) and special education (Deci, Hodges, Pierson & Tomassone, 1992). Controlling motivation style impairs students by thwarting autonomy and stimulating negative feelings like anger and anxiety (Assor et al., 2002; Reeve & Tseng, 2011) and thus increasing their amotivation and decreasing engagement, self-regulation, learning, achievement and well-being (e.g. Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012) levels (Reeve et al., 2014).

#### **Autonomy Supportive Intervention Programs**

Research has shown that teachers can learn being more autonomy supportive (Reeve, 2009). Systematic Autonomy Supportive Intervention Programs (ASIPs) are developed and applied to help teachers provide autonomy support more efficiently for their students (Reeve & Cheon, 2016). Painter (2011), asserts that autonomy supportive teaching is related with accomplishing three key tasks: 1. Helping teachers gain awareness on their controlling behaviours and become less controlling, 2. Training teachers on the benefits of autonomy supportive teaching style and 3. Helping them learn the essential skills and behaviours to apply autonomy supportive teaching style. The skills that a teacher needs to develop to be an autonomy supportive teacher are listed (Allen & Shaw, 2009; Cheon, Reeve, Yu, Taking the perspective of students, (b) & Jang, 2014) as follows: (a) Applying educational methods that nurture their psychological needs, (c) Utilizing an informant and non-controlling language in communication with students, (d) Providing rationales and explanations for their requests, (e) Being patient, (f) Acknowledging and accepting their negative feelings.

ASIPs are beneficial for not only providing information and teaching strategies for teachers, but also as helpful tools for conceptual change and vocational development (Reeve & Cheon, 2014). Once teachers embrace the autonomy supportive teaching style, they can provide a better learning environment for their students with vital benefits like enhanced engagement, achievement and well-being (Jang, Reeve, Ryan, & Kim, 2009; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). These benefits for teachers and accordingly students are evidenced to endure even in 1 year follow-up studies (Cheon & Reeve, 2013; Cheon et al., 2014; Reeve et

al., 2004). One of the most comprehend meta-analysis in this field (Su & Reeve, 2011) addresses 19 research studies. Mostly studied samples are high school (Reeve et al., 2004; Tessier, Sarrazin, & Ntoumanis, 2010), college (Williams & Deci, 1996) degrees or specific branches (Cheon et al., 2014; Kaur, Hashim, & Noman, 2015). Very limited amount of studies are designed for elementary school teachers (Collins, 2001; deCharms, 1976). The number is similarly small for Turkish elementary school samples (Arcagök, 2016; Calp, 2012, 2013; Marbouti, 2015), most of which are descriptive studies. The effectiveness of ASIPs is evident for preservice teachers (Barch, 2006; Reeve, 1998) as well as experienced teachers (de-Charms, 1976). The ASIP trainings are found to be beneficiary for both motivation styles of teachers and the motivation and engagement levels of students (Cheon & Reeve, 2015). According to Ryan, Connell, & Deci, (1985), one of the most important findings of SDT studies is the gradual decrease in the intrinsic motivation levels of students throughout the elementary school years (deCharms, 1981; Harter, 1981). This decline addresses a great loss in educational motivation. Accordingly, the ASIP studies for elementary school teachers are regarded as more essential. Thus, the aim of this research is examining the effectiveness of Autonomy Support Training Program on the motivation and perceived autonomy support levels of fourth degree students and learning the opinions of their teachers about the program applied. The hypothesis for the quantitative data and the sub-problems for qualitative data of the research are as follows:

*Hypothesis 1:* Students of teachers attended the Autonomy Support Training differ from the control group students in Learning Climate Questionnaire pre /post-test averages.

*Hypothesis 2:* Students of teachers attended the Autonomy Support Training differ from the control group students in l'Échelle de Motivation en Éducation (EME) pre/post-test averages.

*Sub-problem 1*: What are the experiences of students with their teachers that attended the Autonomy Support Training Program?

*Sub-problem 2:* What are the opinions of teachers about the Autonomy Supoort Training and the consultation process?

#### Method

#### **Research Design**

The research is based on a sequential explanatory mixed models design, including a quantitative and two qualitative datasets. Additionally, it is a pretest-posttest between groups quasi-experimental study conducted with availability sampling. Classes were assigned randomly to intervention and control groups.

#### Participants

This research was conducted in a Turkish private elementary school in İzmir. The school had eight classes of fourth degree. Teachers of these classes were delivered to two equivalent groups (intervention and control groups) according to years of experience and the groups were randomly assigned as intervention and control groups. Each group consisted of four teachers, including two moderately experienced (av. 10 years) and two experienced teachers (< 25 years). Intervention group included three female and one male teachers. while all four control group teachers were female. All 185 students attending the classes of these eight teachers were considered as the student sample of the research. Students were defined as intervention or control group according to their teachers. 162 of these students completed the T1 questionnaire, 79 ( $n_c$ = 39,  $n_m = 40$ ) in intervention group and 83 ( $n_f = 38$ ,  $n_m = 45$ ) in control group. Average age of the students was 9 (ss = .48). The final sample of 123 students that completed all four waves of data collection represented a retention rate of 75 % (123/162). This final sample consisted of 55 ( $n_e = 29$ ,  $n_m = 26$ ) intervention group and 59 ( $n_f = 31$ ,  $n_m = 28$ ) control group students.

#### Procedure

The experimental procedure was conducted only with intervention group teachers. Qualitative dataset was gathered from intervention group teachers by semi-structured interviews and from intervention group students by weekly diaries. The quantitative dataset was collected from the whole student sample (both experimental and control groups) in four waves. The intervention procedures were conducted in two parts as the training and consultation sessions. All training and consultation sessions were videotaped due to permission from school administration and under informed consent from participating teachers. At the end of each session, researchers discussed on the context and the intervention processes via video records.

#### **Autonomy Support Intervention Program**

The primary aim of the Autonomy Support Intervention Program is to help teachers embrace a more autonomy supportive and less controlling attitude towards their students during teaching processes. The training consists of phases, namely introducing the basic components of Self-Determination Theory and correspondance of these components in education field, and supporting teachers to apply the principles of the theory in their classrooms in interaction with their students. The content of the training is structured based on the main strategies used for enhancing the autonomy support of teacher from various degrees and branches, and considering the developmental psychological needs of elementary school students. Additionally, prior to the process of developing the program, semi-structured interviews were conducted with elementary school teachers to learn the attitudes of teachers in Turkey about the position of autonomy support in teacher-student relations. After the training program was developed, it was reviewed by an academician from the Division of Curriculum and Instruction, and the content was finalised accordingly.

### Consultation

After the completion of the Autonomy Support Intervention Training, totally six biweekly consultation sessions were held with intervention group teachers throughout the semester. Each consultation session took approximately one hour. The topics reviewed in the sessions were the classroom implementations of autonomy support, psychological needs satisfaction, and enhancing motivation. Teachers were asked how they evaluate their learning outcomes and which difficulties they encountered.

### Measures

Quantitative data was collected from all participating students wia inventories, whereas the qualitative data was collected by diaries from intervention group students and by structured interviews from intervention group teachers. One of the researchers kept field notes during the process.

## Academic Motivation Scale

The scale was developed by Vallerand, Blais, Brière, & Pelletier, (1989) to assess the motivation levels of students. It is adapted to Turkish for elementary school degree by Kara (2008). The scale originally consisted of 28 items with 6 subscales. Participants are expected to respond to each item on a scale ranging from 1 (not true at all) to 7 (completely true). The subscales of the original form are: amotivation, external, introjected, identified and integrated regulation and intrinsic motivation. Vallerand and Bissonnette (1992) assessed the variability and reliability of the scale with the participation of 935 college students in Canada. Cronbach alpha values varied in a range of .76 to .86, only the Identified Regulation subscale was .62. The test-retest reliability analysis revealed values between .69 and .81. The Turkish adaptation was implemented by Kara (2008) for elementary school fourth and fifth grade students. He found 4 subscales, each with 3 items. Items were responded as 3 (yes), 2 (I have no idea) and 1 (no). The 4 subscales were: "Identified External Regulation", "Amotivation", "Introjected External Regulation" and "Intrinsic Motivation". The Cronbach alpha is .84 for the scale and respectively .79, .78, .80 and .78 for subscales. Within the current research, the Cronbach alpha is .60 for the total scale and respectively .66, .75, .83 and .66 for subsales.

# Learning Climate Questionnaire (LCQ)

The questionnaire is adapted from the Health Climate Questionnaire of Williams and Deci (1996). It is a 6 item version of the original 15 item

questionnaire. Within the current study, the six item short form is adapted for Turkish students of fourth year (n=643) by Kandemirci and Cihangir Çankaya (2015). Exploratory factor analysis revealed a single factor solution explaining the 63.33 of the total varience. Factor loadings of all six items were over .75. The Cronbach Alpha for the whole scale is .88.

### **Teacher Interview Form**

The semi-structured form was based on the five critical levels of Guskey's Professional Development Assessment approach (Guskey, Whitty, Aggleton, & Fitz, 1990). The 15 item draft was revised with lecturers from *Guidance and Counseling* and *Curriculum and Instruction* Divisions. After a rehearsal with a research assistant, the form was finalized with 10 items.

#### **Student Diaries**

The diary forms were structured partially open-ended to facilitate the students to express themselves. Lecturers from *Guidance and Counseling* and *Curriculum and Instruction* Divisions checked the draft for suitability. The form invited students to write a memory they experienced with their teacher that week. To investigate the meaning of this memory, they were required to write what they thought and how they felt in this memory. Finally, to understand their needs, they were expected to describe what they would like to happen in this experience.

## **Data Collection and Data Analysis**

Quantitative data was collected from all student participants in four waves. Qualitative data were collected by semi-structured interviews from intervention group teachers and through diaries from their students. For quantitative data, repeated measures analysis was implemented on "PASW Statistics 18". Student diaries were categorized by Quirkos 1.4.0. Categorical and contingency analysis were chosen respectively. Two independent raters took part in this analysis. One of the researchers coded the whole data and defined the themes, then the other researcher coded 30% of the data independently. Later, the two researchers compared their themes. The consistency rate in the first comparison was 70%. This rate is acceptable for the first comparison according to Miles and Huberman (1994). The researchers discussed the inconsistent themes and codes and compromised. Teacher interview transcriptions were processed through a five step content analysis, namely organizing, coding, identification of themes according to text, re-examination of the categories and reporting (Bogdan & Biklen, 1998). The transcriptions were read and then coded by two independent raters from Guidance and Counseling Division. The coding was made according to the literature and Guskey's 5 critical levels (Guskey, 2002). After independent coding, raters worked together for consensus. After the agreement on themes, a third researcher compared the codes and themes and finally the themes were integrated.

### Validity and Reliability

The primary precaution for validity and reliability is the use of various tools (questionnaries, student diaries, teacher interviews, field notes) simultaneously for data collection. The data sources were chosen in accordance with the aim of the research. All tools were chosen and developed under expert consultancy. Teacher interviews were realized in a sincere way. The questions were asked to every teacher in a similar manner, data was coded with a consistent conceptualization. Another precaution was the field notes that the researcher kept throughout the process. The researcher added her own observations in these notes. All the training, consultation and teacher interviews were videotaped. Both diaries and interviews were continuously re-read, interpreted and common patterns were discovered. Independent researchers took part in all coding processes. The analyzed data results were presented without interpretation and with adequate amount of direct quotations. The participants, environment and the processes of the research were clearly described in detail.

## Results

## **Quantitative Results**

Quantitative data collected from all participating students in four waves were analyzed using repeated measures ANOVA. Independent samples t-test results confirmed the equivalence of intervention and control group students (p>.05) before the intervention. The analysis unit for Academic Motivation Scale were the Motivation total scores. These total scores were computed according to this formula: (Mtop),  $\int (2XIM) + IdEM - \int IM + (2XIM) dEM$ XAM)] (Calp, 2013; Cheon & Reeve, 2013). Abbreviations of the formula are, IM= Internal Motivation, IdEM= Introjected External Motivation and AM= Amotivation. Repeated measures ANOVAs (2x4) were computed for two groups (intervention and control) and measurement sequence (measure 1, measure 2, measure 3 and measure 4) for each dependent variable. Perceived Autonomy Support scores were computed by directly summing up the scores of the six items of Learning Climate Questionnaire. The assumptions of normal distribution, variance homogeneity and covariance matrice equation were tested and confirmed prior to the analysis. Results for the repeated measures ANOVAs are presented in Tables 1 and 2.

		-				
Source	Sum of df		Mean	F	р	Partial
	squares		square			$\eta^2$
Measurement	114.327	3	38.109	1.765	.154	.016
Group	4.455	1	4.455	.046	.830	.000
MeasurementxGroup	39.407	3	13.136	.609	.610	.005
Error	7252.826	336	21.586			

 Table 1Repeated Measures ANOVA results for Perceived Autonomy Support

 Levels of Students

The results indicated an insignificant interaction for LCQ  $(F_{(l, 336)} = .046, p > .05, \eta^2 = .000)$  between the intervention and the control group across the four measurement occasions, meaning that the training program was not efficient in increasing the perceived autonomy support levels of the students.

Table 2 Repeated Measures ANOVA Results for Motivation Levels of Students

Source	Sum of	df	Mean	Mean F		Parti-
	squares		square			al $\eta^2$
Measurement	6003,167	2.623	2288.882	106.586	.000	.488
Group	18.797	1	18.797	.275	.601	.002
MeasurementxGroup	6.565	2.623	2.503	.117	.933	.001
Error	6308.092	293.748	21.474			

As seen in table 2, repeated measures analysis showed that the measurement effect ( $F_{(2.623, 293.748)}$  = 106.586,  $p < .05, \eta^2 = .488$ ) was statistically significant, whereas the group effect was not significant ( $F_{(1.293.748)} = .275$ ,  $p > .05, \eta^2 = .002$ ). This implies that the change was similar for both groups, there was no significant difference between intervention and control groups in terms of motivation scores.

#### **Qualitative Results**

544 diaries were collected from students of the four intervention group teachers. 124 of them were discarded for not being within the content of the study (e.g. the ones about the other teachers or family relations, the blank ones etc.), so the analyses were conducted on 420 diaries. During the coding, each whole diary written at that week was considered as a unit of analysis. This entailed some of the diaries to be classified under several themes. Thus, the total number of coding on these 420 diaries is 742. Data about the diaries coded under each theme is presented in Table 3. The expressions in the diaries are mostly classified under themes of relatedness (N=250,  $\sum \% = 34.69$ ) and competence (N= 154,  $\sum \% = 20.75$ ).

Theme	Code	F	Code %
	Autonomy	36	4.85
		54	7.28
	Competence	105	14.15
Need	-	49	6.60
Satisfaction	Relatedness	178	23.99
		72	9 70
		12	2.10
		50	7.00
		52	/.00
Climate		30	4.03
	Intrinsic motivation (IM)	86	11.59
Motivation	Extrinsic motivation (EM)	80	10.78
	Total	742	100

Table 3 Classification of diaries in themes

During the coding, many diaries appeared to be classified under several themes. According to many SDT based studies, this co-occurence could be explained as the interrelation of the *needs satisfaction, motivaton* and *classroom climate* concepts (Black & Deci, 2000; Calp, 2013; Dinçer, Yeşilyurt, & Takkaç, 2012; Reeve, & Jang, 2006). Contingency Analysis (Osgood, Suci ve Tannenbaum, 1957) was implemented to contextualise this co-occurency. Data obtained is presented in Table 4.

 

 Table 4 Co-occurrency Frequencies and Percent Values of Variables Coded due to Contingency Analysis of The Diaries

			-							
THE- ME	A+	A-	C+	C-	R+	R-	CC+	CC-	IM	EM
A+	36	1	22	-	20	-	3	-	15	3
	100%	0.99%	18.33%	-	13.07%	-	5.88%	-	12.93%	2.01%
A-	1	54	1	13	4	28	-	15	2	37
	1.56%	100%	0.83%	21.31%	2.61%	26.17%	-	22.72%	1.72%	24.83%
C+	22	1	105	1	39	-	4	-	35	18
	34.38%	0.99%	100%	1.64%	25.49%	-	7.84%	-	30.17%	12.08%
C-	-	13	1	49	2	17	-	6	8	14
	-	12.87%	0.83%	100%	1.31%	15.88%	-	9.09%	6.90%	9.40%
R+	20	4	39	2	178	2	39	1	31	15
	31.25%	3.96%	32.50%	3.28%	100%	1.87%	76.47%	1.51%	26.72%	10.07%
R-	-	28	-	17	2	72	-	25	7	28
	-	27.72%	-	27.87%	1.31%	100%	-	37.87%	6.03%	18.79%
CC+	3	-	4	-	39	-	52	-	3	2
	4.69%	-	3.33%	-	25.49%	-	100%	-	2.59%	1.34%
CC-	-	15	-	6	1	25	-	30	1	18
	-	14.85%		9.84%	0.65%	23.36%	-	100%	0.86%	12.08%

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IM	15	2	35	8	31	7	3	1	86	14
	23.44%	1.98%	29.17%	13.11%	20.26%	6.54%	5.88%	1.51%	100%	9.40%
EM	3	37	18	14	15	28	2	18	14	80
	4.69%	36.63%	15.00%	22.95%	9.80%	26.17%	3.92%	27.27%	12.07%	100%
NTC	36	54	105	49	178	72	52	30	86	80
NTCO	64	101	120	61	153	107	51	66	116	149
TC %	100.01	99.99	99.99	100	99.99	99.99	99.99	99.97	99.99	100

A+: Autonomy Positive, A-: Autonomy Negative, C+: Competence Positive, C-: Competence Negative, R+: Relatedness Positive, R-: Relatedness Negative, CC+: Classroom Climate Positive, CC-: Classroom Climate Negative, IM: Intrinsic Motivation, EM: Extrinsic Motivation, NTC: Number of Total Codes, NTCO: Number of Total Co-Occurrence. TC %: Total Column Percent.

In Table 4 both the coding frequency and the co-occurence frequency values are presented for all variables. For example, the 36 in the intersection point of A+ column and A+ row represents the number of total codes (NTC) of A+, whereas the 22 in the intersection point of A+ and C+ refers to their total number of co-occurrence. Finally, the 64 at the bottom of A+ column addresses the number of total co-occurence of A+ with all the other variables.

#### **Theme 1: Basic Needs Satisfaction**

Basic needs satisfaction theme is coded as autonomy, competence and relatedness for student diaries. Of the 90 expressions regarding autonomy, 36 were coded as autonomy positive (A+) and 54 were coded as autonomy negative (A-). The co-occurrence rates of autonomy satisfaction expressions are 34.38% for competence satisfaction and 31.25% for relatedness satisfaction. Accordingly, the highest co-occurrence proportion of autonomy satisfaction expressions is inferred to be with competence satisfaction expressions. Below is an example of the diaries expressing a co-occurrency of autonomy satisfaction with another need satisfaction:

"My teacher forgot to take a fork when we were in the dining hall. She asked me to bring one and I brought for her. I felt happy and thought whether my teacher would be happy or not. I would like to be able to help my teacher more." [P 184 (1/1)] (A+, C+, IM)

The diaries mentioning the unsatisfied autonomy needs (n=42) appeared to be containing negative feelings and thoughts. In such diaries, students often suggested alternatives to their experience to express their dissatisfaction. Some of these codes co-occured with other themes. Total co-occurence rates of autonomy negative were 36.63% for extrinsic motivation, 27.72% for relatedness negative and 14.85% for negative class-room climate. 105 of the 154 diaries mentioning competence are coded

as positive (C+), and 49 are coded as negative (C-). The following is an example of a student reporting the challenge and encouragement by the teacher in terms of perceiving the competence need satisfied.

"My teacher called me to the blackboard many times this week., I felt *happy* and thought *I could solve the problems*. I would like (*my teacher*) to be happy." [P 122 (2/3)] (C+)

32.50% of the diaries coded as C+ are also coded as R+ with the highest co-occurrence rate. IM follows with 29.17% and A+ with 18.33%. The diaries regarding the frustration of competence support seem to include expressions of students feeling inadequent, unsupported and punished. The accompanying feelings are frequently (n=45) negative feelings like sadness, shame and anger and the thoughts are generally based on perceptions of incompetence. 27.87% of these diaries are also coded as R-, 22.95% of them as EM and 21.31% as A-. Of the 250 diaries regarding relatedness need, 178 are coded as R+ and 72 are coded as R-.

"We had a chat at lunch today. I felt *happy* and thought *that my teacher likes me*. I would like *nothing else*." [P? (2/3)] (R+)

25.49% of the diaries coded as R+ are also coded as C+, 25.49% of them as CC+ and 20.26% as IM. This reveals that the diaries mentioning relatedness satisfaction also state competence satisfaction and positive classroom climate with a high rate. The most frequently expressed emotions in the diaries with thwart of relatedness need are sadness, shame and anger; the most frequently accompanying thoughts are the negative ones toward themselves, teachers or the conditions (n=62). Students wrote in the alternatives about their dissatisfaction and expressed their wishes to have experienced it in a different way. 26.17% of these diaries are also coded as EM, another 26.17% are coded as A- and 23.36% are coded as CC-. That means the highest co-occurence rates of R- codes are observed with EM codes. All of the 28 diaries coded as R- and EM include expressions where the teacher got angry, punished or banned a behaviour. 82 diaries were coded under Classroom Climate theme, 52 of them were CC+ and 30 were CC-. In the CC+ diaries students shared memories where positive emotions arised as a result of their teacher's behaviour. The dominating feeling in these diaries was happiness, experienced with positive thoughts and the desire for maintaining to keep these feelings.

"This week our teacher made us laugh a lot with jokes. I felt *happy* and thought *that this is so nice*. I would like *to keep having fun*." [P24 (1/6)] (R+, CC+)

The co-occurence rates for CC+ are 76.47% for R+, 7.84% for C+, 5.88% for A+. These results reveal a quite high co-occurence rate of CC+

and R+. The diaries coded as CC- refer to the memories reminding of a negative environment perception in class. In these diaries the dominant feelings are reported as fear and sadness, the accompanying thoughts are questioning their own or their teacher's behaviour. 37.87% of these are also coded as R-, 27.27% as EM and 22.72% as A-. Taken together, CC+ appeared to co-occure mostly with R+, whereas the co-occurencey distribution of CC- was more balanced between R-, EM and A-. This refers to a high relationship between positive relatedness with teacher and positive classroom climate.

Of the 166 diaries nested under motivation theme, 86 were coded as intrinsic motivation (IM) and 80 were coded as extrinsic motivation (EM). Extrinsic motivation code included all the sub categories (external, introjected, identified and integrated). The diaries coded as IM mostly include the emotions of happiness and curiosity, and thoughts of satisfaction. The continuation of the status was frequently expressed as a wish.

"Teacher was teaching us very good. I felt very good and thought I was happy. I would like my teacher to not ever stop." [P177 (2/1)] (C+, IM)

30.17% of the IM codes co-occured with C+, 26.27% with R+ and 12.93% with A+. This means, intrinsic motivation co-occured mostly with competence satisfaction. In EM dimension, students shared memories where they were rewarded or punished by their teachers. Students expressed positive feelings and thoughts about rewards and negative emotions and thoughts about punishments. 24.83% of these diaries coded also as A-, 18.79% of them as R-, 12.08% as C- and again 12.08% were also coded as CC-. This reveals that the expressions mentioning extrinsic motivation co-occured mostly with autonomy thwart.

Taken together, the results from diaries seem consistent with the Self Determination Theory body of literature. Needs satisfaction, positive classroom climate and intrinsic motivation are moderately related, whereas the needs thwart is related with negative classroom climate and extrinsic motivation. As autonomy is moderately related with competence and intrinsic motivation, competence and relatedness dimensions are found both co-related and highly related with intrinsic motivation. This structure between dimensions is widely discussed in discussion part.

#### **Opinions of Intervention Group Teachers About the Effectiveness of the Autonomy Support Intervention Program**

The results of interviews with intervention group teachers are classified under two categories as contribution and teaching process. The categories, themes and codes are presented in Table 5.

Ca	tegories, Themes and Codes	N	
1.	CONTRIBUTION		
	1.1. Contribution to Teachers		
	1.1.1. Conceptual Learning	4	
	1.1.2. Cognitive Awareness	4	
	1.1.3. Positive Feelings	3	
	1.1.4. Behavioral Change	3	
	1.1.5. Job Satisfaction	3	
	1.2. Contribution to Students		
	1.2.1. Positive Classroom Climate	3	
	1.2.2. Increase of Engagement	3	
	1.2.3. Development in Relations with Teachers	4	
	1.3. Necessity	4	
2.	TEACHING-LEARNING PROCESS		
	2.1. Process of Training	4	
	2.2. Difficulties in Applying	3	
	2.3. Advices	4	

 Table 5 Categories, Themes and Codes on The Efficiency of Autonomy Support

 Intervention Program

#### 1. Category: Contribution

The two themes obtained from the teacher interviews, about the contributions of the Autonomy Support Intervention Program are *contribution to teacher* and *contribution to students*.

a. Contribution to Teacher

Teachers reported that the training provided them contributions on conceptual learning (n=4), cognitive awareness (n=4), positive feelings (n=3), behavioral change (n=3) and job satisfaction (n=3).

In *conceptual learning*, teachers declared that at the end of the training they learnt the basic concepts of SDT; autonomy, competence and relatedness and their functions in education process. For instance, teachers explained competence as being aware that the students may achieve at different levels, and personal characteristics should be considered in assessment.

"Feeling competent depends on the person... it depends. This is natural because every student has a different competence". [T3] "...I learnt that every child is an individual, different from one another, their ways of learning, interests, experiences are all different, that's why I should treat and assess them not as a whole but as different individuals." [T1]

In terms of *cognitive awareness*, teachers reported a change in the way they see and approach to their teaching behaviours, their classroom

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and students. These changes are reported to have occured as recognizing their own deficits, getting to know themselves and their students, reconsidering their differences and different expectations. They explained that noticing their own deficits is one of the most important acquisitions in the progress of changing. They defined this awareness as a driving force to change their teaching behaviours.

"...I realised what I am lacking first of all. It wasn't likely, I used to feel like everything was ok with me....Noticing my own insufficiencies, trying to correct myself as I said. I hope that I can be a different teacher in the following years." [T1]

Within the concept of positive feelings, teachers explained how these positive feelings are related with applying this new approach to the classroom environment. Teachers defined themselves as calmer, milder and more positive than before. They associated these new mood firstly with the increase in their own motivation. They expressed that as they adjusted their expectations from the students, their stress levels decreased and they started to feel less nervous. One of the teachers explained that his/her feature of impatience used to result in missing out the rhythms of students and by readjusting this feature he/she realized becoming calmer:

"... generally, being calmer... because I used to be hasty, I wanted everything to just happen quickly. Sometimes I cannot do but in times I try to calm myself down. Now I try to direct myself like 'I should do this way'.." [T2]

Within the *behavioral change* code, teachers explained that as they started to reflect autonomy support, structuring and involvement to their teaching behaviours by providing choices, positive feedback and encouragement, they started getting positive outcomes. To provide autonomy support, teachers told that they created opportunities for their students, they tried to consider their needs and tried to create a more free environment. Besides, by explaining them that there are rules to obey as well, that this freedom is not limitless, they started to make decisions together and created a more positive classroom climate.

"Before, I was most generally giving them instructions like: "Do this like this, do that like that." but now I am creating opportunities. I can provide them with choices like: 'Do you think we should do it like this or like that?' We do the same things at the end but they can be active in deciding." [T2]

Teachers added that, the progress beginning with teacher-student relationship also developed the relations of students with each other. One of the teachers shared this experience explaining the importance of interpersonal involvement: "When you listen and understand the other person, many things become easier. Let's say two students are joking with each other and one punches the other. Before I would think that 'I can expect this behavior from this kid'. But when I went and listened to them I realised that the other kid frustrated him first. They were both happy that I listened to them and the problem was solved. They did not get any punishment. Normally I would not let them go out for the recess or I would punish them in another way." [T2]

Teachers expressed a decrease in *Job Satisfaction* levels due to difficulties in providing student engagement because of the overloaded curriculum and the strict rules of the school and getting tired because of making too much effort (n=4). They declared the effects of the change in their job as being more peaceful, less feeling of burnout, higher motivation and willingness to teach, accordingly more efficiency at work. These are the words of a teacher:

"As I said, we have to obey the school rules and we cannot do things much differently, but when I realise some of their differences and reach them with small things I believe that we will have a better year. Being happy and positive means so much. Neither I nor they would feel worn out." [T1]

#### b. Contribution to Students

Teachers assessed the reflections of the training on students under the topics of *positive* classroom climate (n=3), increase in student engagement (n=3) and development in relations with teachers (n=4).

Within *positive classroom climate* code, teachers reported an enhancement in the quality of their relations with students due to the change in their perspective and behaviours, which also influenced the classroom climate. Teachers expressed their positive observations as less fear, more sincerity, higher student motivation and enhanced student self confidence. This is how a teacher conveyed her/his thoughts:

"Last year my behaviours were.. I always hear this: they both loved and bewared.. It was unpleasant for me to be like this. Now we make more jokes in lessons, we laugh more, have more fun together, there is a warmer climate. Academic achievement is not everything.. (the important thing is) to be recalled as a good teacher." [T1]

In *increase of engagement*, teachers explained that parallel to their more positive and encouraging approach, their students became less afraid of making mistakes, more eager to engage in lessons. One of the teachers reveal this development with these sentences:

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"They became more self-confident. They answered the questions even they were wrong. These were positive outcomes." [T3]

Within *development in relations with teachers* code, teachers described the change in their relations with their students as more attachment to teachers and communicating more frequently and directly with teacher. One of the teachers explained the change as follows:

"...but now I see that the student comes and explains me: "I could not do my homework but I will complete it in the recess... this is because... I could not do it, I forgot my book at home, or I forgot it here... I do like this change and ask myself why I did not do this before and my students always felt tense and under pressure in front of me..." [T1]

Another teacher explains their closeness with their students with these words:

"I am trying to chat with them more often. For example they come and tell me about their family life. They come and speak with me during breaks and lunchtime." [T2]

#### c. Necessity

All participating teachers (n=4) found this training program beneficial and essential. Teachers explained their opinions that this training should be applied to preservice teachers and the concept should be expanded to the administration, parents and students as well.

"Preservice teachers, inexperienced teachers and even parents should learn these. Because education starts in families. I definitely think that parents must know all these." [T2]

#### 2. Category: Teaching-Learning Process

The Teaching-Learning Process was evaluated under three themes namely *procedure of the program, difficulties in applying* and *improving the training program* 

#### a. Procedure of the program

Teachers generally declared they were pleased with the content and the procedure of the program (n=4). Teachers revealed that they found the concept beneficial, they found the activities interesting, they found the activities and sharings they involved as more helpful and enduring, they had the opportunity to learn from each other and got benefit out of the feedback.

"Each session helped us discover another learning. We had a different team work. There was a nice interaction. With the examples of our colleagues, their feedback from the previous sessions and their ideas about the
ideal way of teaching we developed by multiplying our knowledge." [T4]

In addition to expressing that they learnt form various activities, the most catchy activity reported by the teachers was the Picture completion (n=4). This is both because it was the final activity, it involved active teacher involvement and also it was an activity summarising the whole process.

"The last activity. The one that four of us drew one picture explaining the benefits of the training. It was very impressive for me." [T4]

Teachers (n=3), reported that being actively involved in activities provided a more pleasing and fruitful learning process.

"The activities that we actively involved were more enjoyable. We are also like children, when we are more involved, we have more pleasure." [T1]

### b. Difficulties in Applying

Teachers told about some difficulties they faced while trying to adapt the elements of the training with their students (n=3). These were primarily balance between classrooms, overloaded curriculum and that parents were not trained. Both in consultation sessions and in individual interviews teachers said that the difficulties in the education system are hindering for them. One teacher mentioned the limiting impact of keeping up with the curriculum with these sentences:

"I think it would be better if we were not dependent on definite books and page numbers while teaching. How we feel... we feel limited." [T3]

Finally, they emphasized that, because the training was only targeting teachers, it is not possible to make a holistic evaluation:

"We as teachers take the autonomy support training. But the others; students and their parents do not know about it. Parents do not know their children well. Espacially the parent side is very important." [T4]

### c. Advices

Teachers (n=3), adviced the content of the training to be expanded to students, school administration and parents as well. Another advice is to use a more informal and less academic language during the training.

"(Instead of an indirect intervention) you can directly work with students as well. This might work better." [T2] "School administration is also very important. Their perspective of autonomy is essential. As much as teachers and students, parents and school administration must also be aware of these factors." [T4]

### Discussion

The present study examined the efficacy of an Autonomy Support Intervention Training Program on the motivation and needs fulfilment levels of elementary school fourth grade students and obtained the evaluation of teachers about it. Quantitative and qualitative findings are discussed in detail.

### **Discussion of the Findings on Motivation**

According to repeated measures analysis, there was no significant difference between intervention and control groups in any of the four waves. This result does not seem in line with the other experimental studies. Many studies with similar design (Cheon et al., 2014; deCharms, 1976; Jang, Kim, & Reeve, 2012) reveal significant increase in the motiavion levels of intervention group students. The present results may be explained in accordance with the research design and variables related with teachers and students. Unlike some other studies (Barch, 2006; Reeve, 1998), this research was conducted in real classroom conditions and lasted a whole semester. In addition, the target of this study was not teachers of a definite branch but elementary school teachers who spend almost the whole day in the same class with the same students in various lessons. These factors widened the scope of the program, but the inventories were not as wide enough to control all the basic and confounding variables. On the other hand, even the four waves of measurement provided a rich source of longitudinal information, the frequency (once in 3 months) of the waves may have caused order effect; hence fatigue.

Student diaries reveal that intrinsic motivation is reflected mostly in diaries that also mention competence need fulfilment. This close connection of the two variables is also evident from studies of both formal (Grolnick, Ryan and Deci, 1991) and special (Deci et al., 1992) education studies. Likely, Vallerand et al. (1989) reported that the students with higher intrinsic motivation reflect more positive feelings in class, enjoy academic duties more and express more eduational satisfaction than the less autonomous students. In our study, 10 of the 35 diaries coded as IM+ and C+ were also coded as A+. This finding is also in agreement with other studies. Competence support (e.g. positive feedback) enhances general motivation level, whereas it only can increase intrinsic motivation and identified motivation levels when presented in an autonomy supportive way (Ryan, 1982). Extrinsic motivation expressions are mostly seen in diaries with autonomy needs thwart. This explains clearly that the students controlled with external stimulants (reward, punishment or enforcement) do not feel autonomous. Supporting this finding, deCharms (1976) reported that students experiencing autonomy thwart in their relations with their teachers feel themselves like pawns in the classroom because of the external control and pressure, which also yields a decrease in their well-being.

# **Discussion and Interpretation of the Autonomy Support Findings**

Intervention and control groups showed no significant difference in LCQ scores and there was no significant difference across the measurement occasions. LCQ scores of students showed no significant difference between intervention and control groups and across the measurement occasions. Yet, although not statistically significant, the decrease of control group is more than the intervention group between third and fourth waves. This may be evidencing that it takes time to observe the efficacy of the training (Leptokaridou, Vlachopoulos, & Papaioannou, 2014). As the students were in their graduation year, it was impossible to get more measures. It may give a more clear idea to examine these results together with diaries and teacher interviews. Results revealed that the number of diaries mentioning the perception of autonomy thwart (n=54, %=7.28) is more than the ones mentioning autonomy support (n=36, %=4.85). This addresses the necessity to consider autonomy support more carefully. Autonomy thwart highly co-occured with relatedness thwart which is seemingly in proportion with negative classroom climate. These findings are considerate with other studies. Aelterman et al. (2014) emphasizes the importance of an autonomy supportive, well structured and involved environment created by teachers for a motivating teaching style. Teachers stated in interviews that their relations with students enhanced in accordance with the development in their approach and behaviours and relatively the classroom turned into a less fear based and warmer environment, which led to an improvement in the observed motivation and self confidence of students. As distinct from the quantitative findings, these taecher statements address that they have observations about the positive change in classroom climate.

## Interpretation and Discussion of Qualitative Findings

### Diaries

Besides providing objective data, the diaries are also important to complete a gap mentioned in the existing literature. Diaries were helpful for a natural observation of the classroom climate and the teacher-student relations. This part includes the discussion of the dimensions and an integrative interpretation of the findings. Diary analysis address the relation of autonomy support with structuring, interpersonal involvement and intrinsic motivation. Black and Deci (2000) also found that the autonomy support increases the competence level as well. Deci, Betley, Kahle, Abrams, and Porac (1981) revealed that the students of the autonomy supportive teachers have higher scores of competence, intrinsic motivation and self-confidence. Haerens, Aelterman, Vansteenkiste, Soenens, and Van Petegem (2015) advocated that while perceived autonomy support enhances intrinsic motivation, perceived controlled teaching causes amotivation and extrinsic motivation through needs thwart. These data, evaluated considering the content of the diaries, reveal that feeling supported and encouraged strengthens student-teacher relationship and raises the student motivation of discovering and learning. Along with this, competence and relatedness need satisfaction co-occured quite frequently.

Ryan and Powelson (1991) also stated the relation of relatedness with competence and autonomy and accordingly with motivation. They emphasized that the primary outcomes regarding education are based on emotional processes in the class and a suitable climate serves both learning and developmental purposes. The quantitative findings of the present research evaluated in combination with this research, it is possible to say that students perceive the classroom climate more positively and feel themselves more competent when they think that they are in a satisfying relationship with their teacher. At this point, the co-occurrence of relatedness satisfaction with positive classroom climate becomes more meaningful. The diaries with an attribution to positive classroom climate co-occured with relatedness support perception with 76.47%, while the total rates of competence and autonomy support were only 13%. This might be interpreted that the basic need of students is being in positive and warm relationship with their teacher even before being autonomous and competent.

The co-occurrence rates of all the dimensions examined together, autonomy need satisfaction is related with competence and relatedness moderately, competence need satisfaction and relatedness need satisfaction are highly co-occurrent. Positive classroom climate is found highly related with relatedness need support. Intrinsic motivation is highly related with competence and relatedness, whereas it is moderately related with autonomy. Taken together, all three need fulfilment components are highly or moderately co-related, and positive classroom climate and intrinsic motivation are also related with them. This pattern seems to confirm the co-relationship between need fulfilment, positive classroom climate and intrinsic motivation mentioned in SDT (Deci & Ryan, 2016; Sierens, Vansteenkiste, Goosens, Soonens, & Dochy, 2009).

To sum up, it is understood that students mentioned relatedness and competence needs more than autonomy needs in their diaries. This might be explained better in a cross-cultural context. Kağıtçıbaşı (2000) proposes a definition for collectivistic cultures as "culture of relatedness" and for individualistic cultures as "culture of separateness". Based on this definition, Kağıtçıbaşı (1996; 2000) defined a third identity, called "autonomous-related" self; combining collectivistic (relational) and individualistic (autonomous) elements within itself. The individual can be both autonomous and related; with autonomy and relation needs at once. An autonomous person may also look for the care and support of another one (La Guardia, Ryan, Couchman, & Deci, 2000). On the other hand, as autonomy need thwart is found to be strongly related with extrinsic motivation, competence and relatedness thwart are found moderately related with extrinsic motivation. An explanation for this might be that control based behaviours impact autonomy perception more than it impacts competence and relatedness perceptions. Feeling the behaviours controlled externally is associated with a decline in well-being (Chirkov & Ryan, 2001; Ryan & Deci, 2000). This might be clarified by the fact that under the conditions of a "carrots and sticks" approach and the need thwart or frustration, students do not have the chance to choose their behaviours and thus they cannot internalize them adequately.

An interesting fact about the diaries is that students sometimes reacted positively to some sources of extrinsic motivation. Besides reacting positively to rewards and positive teacher feedback, they also inferred some positive outcomes from negative feedback and even punishments or prohibitions. For example, some students not allowed to eat unhealthy snacks or go out because of being sweaty, added comments in their diaries that their teacher behaved that way to protect them. This demonstrates that extrinsic motivation is not always construed negatively by students. On the contrary, it might be perceived as nurturing and internalized better given in an autonomy supportive way within a good structuring. In an experimental study endorsing this finding, Deci et al. (1994) found that when the rationale of an uninteresting activity is explained well, the feelings of the participants are acknowledged and they are provided with choices, the level of internalization and integration rises. On the other hand, the cultural perspective should also be considered. Ivengar and Lepper (1999) documented that in collectivistic cultures, intrinsic motivation levels decreased with choices and increased when others made choices for them. Bao & Lam (2008) claimed that the lack of choices may not decrease motivation when the socioemotional relatedness is high, because internalization may protect the sense of autonomy. In another research in Turkey, psychological control is found not significantly related with self-worth (Kındap, Sayıl, & Kumru, 2008). This might be explained in two ways; first is that as children in Turkey experience autonomy support less, they may not be aware of their autonomy need, and the second is that relatedness; getting the closeness of the other person might be seen as a more primary need than autonomy.

In diaries implying competence need fulfilment, the "alternative" sentence was mostly left blank by students, or they filled the gap with expressions such as they want this situation to continue this way, they want to be more successful, significant others (mostly parents) be there witnessing

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them etc. These sharings are thought to be related with the satisfaction children feel about these memories, the fulfilment of their needs and the wish to keep these livings and even that they need witnesses for these positive experiences. In line with this finding, Kusurkar, Croiser and Ten Cate (2011) also emphasize the importance and interrelation of structuring and emotional support in enhancing intrinsic motivation of students.

#### **Teacher Interviews**

Teachers were interviewed about the essence, functionality, benefits, viability, limitations and their advices to advance the program. Teachers explained that the program was helpful for them in various ways. They learnt the basic tenets of Self-Determination Theory and how to put them into practice and they could give examples of their enhanced teaching experiences. Their sharings were in the same vein with Reeve and Cheon (2014), reporting that teachers can learn to be more autonomous and less controlling towards students in the process of teaching.

Intervention group teachers expressed emotional benefits in addition to conceptual learning and cognitive awareness. The fact that teachers describing themselves more positive, calm and moderate after the training, seems consistent with the literature emphasizing a raise in perception of teacher self-competence. Rimm-Kaufman and Sawyer (2004) remark an increase in the teaching efficacy level of teachers after participating in the training program. Correalational studies also proved an increase in the capacity of teachers in need fulfilment, autonomous motivation and psychological well being (Roth, Assor, Kaplan & Kanat-Maymon, 2007; Stebbings, Taylor & Spray, 2011; Taylor, Ntoumanis, & Standage, 2008). The interview findings ascertained that teachers reflected their positive feelings of influence on their students and thus they experienced an increase in their job satisfaction. This is evident from their expressions of feeling themselves as more patient, calm and understanding. A research with Israeli teachers also determined a decrease in the aggression and negative feelings after joining an autonomy support intervention (Kaplan & Assor, 2012).

Teachers in the present study, described the advancement in their job satisfaction levels with an increase in their occupational motivation levels according to their awareness and new skills, which provided less exhaustion and more peace. They even mentioned that this might be releated with the decrease in the level of pain in accordance with the lowered stress they feel. Similarly, Nie, Chua, Yueng, Ryan, and Chan (2014), found that teachers getting more autonomy support from their supervisors felt themselves more autonomous and reported higher degrees of intrinsic and identified motivation. All these findings address the positive affects of the Autonomy Support Intervention Program spreading from teachers to students.

Classroom climate theme showed that with the change in the perspective and behaviours of teachers, the quality of their relations enhanced and thereby the classroom became less fear oriented and warmer, and they observed an increase in the motivation and self confidence of their students. Unlikely the quantitative results, these findings address an increase in the perception of positive classroom climate. Özdemir, Sezgin, Karip, and Erkan (2010) also found that as the academic programs are perceived as more gratifying, the school environment is also perceived as more supportive.

In the student engagement theme, teacher statements address that in the new positive classroom climate created through their constructive and encouraging conversion, students started to be less afraid of making mistakes and accordingly their engagement levels heightened and they felt more courageous to participate in the lessons. A longitudinal study by Cheon and Reeve (2015) also confirmed an increase in student engagement and teacher job satisfaction and a decrease in bodily exhaustion symptoms in conjunction with the the heightened self-efficacy levels of teachers. Besides engagement, teachers also gladly reported a visible advance in the communications of students with them. They said they observed this change especially in more introverted students. La Guardia et al. (2000), in line with this finding, drew attention to the fact that perceived autonomy support level predicts the quality of that relationship.

Taken together, all the participating teachers seem to find this program essential. They agreed that this training should be given to preservice teachers during teacher education process. In a research investigating the opinions of teachers towards autonomy support, Oğuz (2013) suggested the Autonomy Support Training to be presented both in preservice teacher education and as in-service training to experienced teachers. Teachers explained that they found the content of the training beneficial and that they were pleased with the activities. They expressed that they especially benefited from the active participation to the activities and sharings, they learnt from the feedback they gave and received and that these were more enduring for them. Finally, the most common advice they emphasized was widening the scope of the training to students, parents and school administrations. Considering the Ecological Systems Theory (Bronfenbrenner, 1979), the more autonomy supportive the children's micro-, meso-, exoand the macrosystems are, the more auotonomous they can feel.

### **Conclusions and Suggestions**

The fundamental findings of the present research are as follows: (1) Quantitative results implied a significant change in the motivation scores of intervention and control group students between measurement occasions. But the change was not significant between groups. Similarly, perceived autonomy support levels of the students were not found statistically significant between measurement occasions or between groups. (2) Findings inferred from diaries confirmed the relation between needs satisfaction, positive classroom climate and intrinsic motivation proposed in Self Determination Theory (Deci & Ryan, 2016; Sierens et al., 2009). Satisfaction of all three psychological needs (autonomy, competence and relatedness) are highly co-occurrent and they are frequently co-occured with positive classroom climate and intrinsic motivation as well. Likewise, thwart of these needs are also co-occurrent and these are co-occurrent with negative classroom climate and extrinsic motivation codes. (3) Teachers reported in the interviews that they found the Autonomy Support Training Program beneficial. The data collected were classified under "contribution" and "teaching-learning process" categories.

## **Recommendations for Future Research**

1. It will be helpful to keep involving teachers and give them more opportunity to share their ideas and experiences in the advancement and extension process of Autonomy Support Training Program.

2. In the future research, measuring psychological needs by including competence support (structuring) and relatedness support (involvement) scales may provide a more adequate quantitative dataset.

3. Working with more schools and thus more students and teachers may lead to more reliable results. Increasing the number of participating teachers enables to collect quantitative data from them as well.

4. Choosing the intervention and control group teachers from different schools may prevent internal validity threats.

5. The scope of the Autonomy Support Training Program may be extended to students, parents and school administration.

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# INCLUSIVE EDUCATION AND APPLICATION OF INCLUSIVE EDUCATION TODAY

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### INTRODUCTION

Education is the most important criteria in the development indicator of a society. The criterion that is taken into consideration in reaching the level of contemporary society is how the individuals in that society are educated and raised (Balay, 2004). The societies that are aware and conscious of this fact have given necessary importance children to enter the formal education system from very early ages. The importance of education has been discussed as a right for many equal education. As stated in the Constitution and the Declaration of Human Rights, a person has the right to get education regardless of his/her race, language, religion or ethnic origin (As cited by Aydın, 2000). The same right has been also included in the Convention on the Rights of the Child and the importance of the education received by children in accordance with their abilities has been emphasized (Akyüz, 2012). However although education is regulated by a number of acts and laws, this situation seems not to be always possible in practice. It is stated that inclusive education is the most important fact required for everyone to reach their most basic right by preventing these expressed injustices. Children who are disadvantaged in terms of socioeconomics, who have special needs, refugees and at risk are examined under the heading of children in need of inclusive education. However, in both domestic and international studies, it is seen that the situation of refugee children with special needs is examined. In this context, the study aimed to investigate the inclusion of educational studies for refugee children with special needs. Below is what inclusive education, inclusive education in the world and in Turkey works and what the necessary conditions for a successful inclusive education is explained by considering that.

### **Inclusive Education**

Inclusive education which tries to involve all individuals in the society into the education system, has been proposed as a new understanding in education at the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century. A number of definitions have been developed since the day it was first prepared for inclusive education. Inclusive education is an educational activity that helps children learn in a differentiated and diversified educational environment by considering the talents and needs of all children in educational environments (Özcan, 2018). Inclusive education is providing the same service to everyone by ignoring gender, race, language, religion, ethnicity and socioeconomic status of children (Dyson, 1999; Ewing et. al., 2017). Regardless of the definitions, the common feature for inclusive education in all definitions to the nature of inclusive education, in other words because of its availability for everyone, it is stated that many individuals can benefit and thus, positive results can be obtained (Luke and Grosche, 2018).

#### **Inclusive Education in the World**

The main reason underlying the widespread inclusive education activities in the world is that neglecting the right to education in the society and excluding individuals from the education system will have negative consequences in the short and long term in the society. Studies conducted in America, Romania, East and West Africa provided concrete examples of this situation. In the study conducted by Boroson (2017) to examine the relationship between multiculturalism and education in the United States it was stated that many children were left out of the education system in the early 20th century because of their differences and these children intervened in a number of forensic events and disturbed the peace of society. It is stated that new regulations have been made in the education system and this has paved the way for many new initiatives upon understanding that these children should be employed and included in the education system in order to prevent such undesirable events in the society. He stated that inclusive education he considered as one of the new steps has now become popular in many American schools and the unwanted incidents have reduced significantly compared to the pasts as a result of including many people with differences into the education system with this education. Voluntary parents, educators auxiliary staff and children in the classroom stated that they developed together. Margaritou (2017) reviewed the studies in Romania and stated that Romania started inclusive education guite late compared to other countries and the education was applied differently from other countries, there were separate schools for disabled children and children with different ethnic background were included such kind of education but desired results could not be obtained with this kind of education. Hui et. al. (2018) stated that many children were excluded from school in East and West Africa because of low socioeconomic reasons as well as characteristics like race and gender and these excluded children tended to be exposed to neglect and abuse. It was understood that all these problems could be overcome by including these children in the education system and activities on inclusive education started. As a result of the interviews conducted with the children after the establishment of a safe school environment for all children, it was conducted that the children continued their education and the continued education provided success.

Kaputa and Charema (2017) stated that inclusive education practices in their study in Zimbabwe will lead to successful results. In their study, they examined inclusive education applied in 221 primary schools and concluded that the education was generally performed with disabled children with special needs education of these children was also supported in the future and this education should be spread throughout the country since positive and significant results were obtained in the development of these children. In the study conducted by Malakar and Saikia (2017) to investigate the opinions of the parents in India about inclusive education, it was concluded that inclusive education had positive results. The parents stated that they thought their children were more successful in behavioral and academic aspects as a result of inclusive education applied to their children. Another similar study was carried out in China. Tamayo et al. (2017) conducted a study to determine whether or not the children living in rural areas in China could reach the level of their peers in the city through inclusive education activities. As a result of the study, it was concluded that inclusive education applied to children increased their success.

Even though inclusive education is a system that involves all individuals differences can be seen between the countries in terms of its philosophy. This difference becomes particularly evident in developed and developing countries. For example, while inclusive education in developing countries includes only children with special needs who attend school during their school period, it is presented with an understanding covering all individuals and includes long term monitoring studies of these individuals in developed countries. At the same time, this education philosophy is widely applied in all schools in developed countries (Miles and Singal, 2010). Buhere and Ochieng (2013) aimed to investigate inclusive education activities in Kenya. They found that inclusive education activities in Kenya included only children with special needs and were not common throughout the country. In addition the researchers concluded that there was lack of knowledge in the resources infrastructure and educators and administrators. Srivastava et. al. (2015) from other researchers investigating the status of inclusive education in developing and developed countries found that inclusive education was better in developed countries compared to the developing countries in terms of teachers, education methods and policies. In the study conducted by Sharma and Das (2015) on the education system of India they found that the education system in India was structured to exclude children with special needs directed the system in the construction of education system of India and inclusive education was successful and spread throughout the country as a result of the steps taken in education system. Kanter, Damiani and Ferri (2014) found that in Italy, the studies conducted in Italy on inclusive education studies structured to include individuals with special needs have been made legal and widespread in other countries. In the study conducted by Bualar (2016) to investigate inclusive education in Thailand it was determined that information on inclusive education was not sufficient and there was no legal basis although education policies for children with disabilities were known and turned into a state policy. Another study aimed at analyzing inclusive education policies was conducted by Danforth (2016) in the USA. It was stated that social system

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and technocracy had an impact on inclusive education and the practices cannot be carried out as desired. Tchintcharauli and Javakhishvili (2017) examined how inclusive education policies in Georgia were conducted. As a result of their studies, they found that the system could not work effectively and should be provided and students in the education system should be closely monitored and examined.

Research has also been conducted to get the opinions of teachers and administrators who implement and carry out inclusive training activities. As a result of the study conducted by Emam (2016) to examine the opinions of school administrators in inclusive education in the city of Oman located in Southwestern Asia it was concluded that administrators had great responsibilities in inclusive education but the administrators were insufficient about inclusive education. He made suggestions on the necessity of conducting studies to create awareness on inclusive education in school administrators and on the necessity of working as a team. Muega (2016) conducted a study in Philippines with families of children who need special education, educators and administrators in order to get their opinions on inclusive education. As a result of the study, it was concluded that the participants thought that inclusive education could not provide a high level of education. Another study carried out to determine the views of educators belong to Sandhu (2017). As a result of the study conducted by him with 200 educators working, in secondary school in order to determine their opinions on inclusive education, it was concluded that female educators, educators specialized in social sciences, experienced educators and educators received training in this field had more positive views than male educators and those who were specialized in science. As a result of their study conducted to determine the opinions of the educators working in preschool and primary school in Slovenia on inclusive education Stemberger and Riccardo- Kiswarday (2018) determined that educators in both groups had positive opinions in the cognitive field of inclusive education compared to those working in preschool education.

There are studies suggesting that successfully applied and prepared education would contribute to the development of children. In his PhD study in Manchester University, Sakız (2016) developed a school- based curriculum for children with special needs. Six training packages were used in the program by the program educators. These training packages include inclusive education, inclusive pedagogy training, peer relations education, family- based practices education physical space, equipment and furniture arrangement, family education and family activities, meetings with professionals and feedback. In addition, personal information form, school climate scale, social- emotional adaptation scale, academic achievement grade, and semi-structured interview questions were applied to educators and families. The interviews were conducted with twelve administrators and ten parents. In the program school administrators, educators, families and people who are specialized in the field are included in the team. Pretest was performed before starting the program and the posttest scores were taken after the completion of the program. After the study continued for a school year, it was revealed that children with special needs showed significant progress in emotional field especially in social adaptation and peer relations, their attendance to the school increased and they had positive feedback about the development of children as well as the content of the program. As a result, the researcher concluded that the studies to be conducted as school based and as a team would have a positive effect on the development of children.

In inclusive education, experimental studies have been conducted on the effect of the education programs applied besides the classical education concept. Bottge et. al. (2018) wanted to examine whether or not different techniques would affect the success of mathematics instead of classical education. They selected two classes randomly, where inclusive education was applied and was not applied, planned the presence of similar student profiles in these classes as a prerequisite and examined the educational activities in the comprehensive mathematics class and special educational class. During the education, the researchers gave mathematics lesson with the study groups prepared by considering the interest, demands methods in inclusive education classes. As a result of the study, they concluded that the successes of students in the inclusive education class were higher and they made less mistakes and using different methods was effective in the determination of success. Another similar study was carried out by Darrow and Adamek (2018). The researchers examined whether or not different educational approaches in inclusive education classes contribute to the success of education. For this purpose, they used music education. Education consisted of three strategies. In the first stage, music materials were given to children. Visual materials and technological tools were utilized for children to better understand the materials. In the second stage children were asked to write, sing, play an instrument, and even make simple compositions in the later stages in accordance with the given material. In the final stage, electronic games, popular music and videos were included in the learning process by considering the interest and motivations of children. In education, musicians and educators have participated in children's activity. As a result of the study, it was found that the students learnt better with the music in the environment and inclusive education reached its goal. Kılınç et. al (2017) also examined different training methods. As a result of their study investigating the importance of drama studies to help students, who could not speak English, to speak English in inclusive education, they

determined that works were easier with drama activities, a safe classroom environment was established and all of the children participated in the activities.

Llorens and Blair (2017) studied inclusive education for bilingual Mexican children. The researchers examined two families living in Mexico and having bilingual children for more than two years. Children and their families were educated in English after they started school, and also children continued their education at school. As a result of the study it was found that children were found to be more successful in the academic field and also adopted better to the society and their parents supported their children more and they also adapted better to the society and conditions they were living.

### **Inclusive Education in Turkey**

Inclusive education studies in Turkey, the Ottoman Empire is based on the Enderun School. Children of different ethnic cultures in the Ottoman Empire were educated together in madrasahs (Kılınç, 2012; Uğuz, 2019). However given the political situation in the country it concluded that on end to this practice (Ödemiş, 2014) and inclusive education studies in Turkey were made for children who need special education.

Inclusive education studies in Turkey have recently configured specifically for children with special needs up to. However, although the education activities of the children with special needs have been emphasized, deficiencies have been determined in this regard. This is clearly stated in the researches. In the study conducted by Bayraklı and Sardohan- Yıldırım (2012) to investigate the general and special education policies in Turkey and in the world in the framework of new education, they concluded that there were still problems in special education in Turkey. Çağlar (2012) concluded that there was still no normative value for inclusive education in Turkey and the provisions for preventing discrimination were not even included in the Disability Law.

The traces of this condition are seen more clearly in the studies conducted because of seeing inclusive education equal with inclusion education especially in the studies conducted in Turkey. In their study Ereş and Candan (2017) interviewed with the parents of children receiving inclusion education to determine the problems experienced in inclusion education policies. As a result of the study, it was concluded that the educators experienced problems due to their cognitive and emotional inadequacies children who received inclusion education had problems with the educators because of this reason, and there were problems due to the disruptions in educational policies and negative behaviors of school administrators. It is often indicated that there are problems since the policies about inclusive

education in Turkey are not structured well enough. In the light of this fact, Anılan and Kayacan (2015) aimed to determine the opinions of the educators applying inclusion education in their study. As a result of the study conducted with ten educators, they concluded that educators had difficulty especially in controlling since they did not receive a planned education although their attitudes towards inclusion education were positive. Karadeniz-Hacısalihoğlu et. al. (2015) also a stated that there were problems due to the fact that the educators did not receive a planned education during their education process and conducted face- to-face interviews with educators in their qualitative study. As a result of their study conducted with seven educators, they concluded that the educators performed the educational activities with traditional methods and by ignoring individual differences and they needed to be guided in inclusion. Another important factor in success of both inclusive education and inclusive education is the cooperation to be made with the family. In this context in the study conducted by Yılmaz (2013) with thirty educators through face- to- face interviews it was concluded that the education was not successful due to lack of cooperation with the family although appropriate education was given to children in the classroom. The infrastructure is as important as the establishment of the cooperation with the family along with the adequacies of the educators in the success of the education. Y1lmaz (2005) stated that children with physical disabilities had the right to education just like their peers who have normal development, and the biggest obstacle for these children not to participate in the education system was the deficiencies in the physical structure. He made suggestions that there architectural arrangements needed to facilitate the education of these children with special needs should be done as soon as possible by professional teams. Aykara (2011) stated that in the schools where children with physical disabilities were educated in his study started with the assumption that there were problems in inclusion applications due to insufficiency of physical environment. As a result of the study conducted with seventy children, he stated that there were problems related to inclusion education and the inability to arrange, physical environments especially for these children formed an obstacle to the success of education. Y1km1s et. al. (2015) who dealt with a similar subject from another point of view aimed to determine the effects of educational environment on success within the scope of this aim, they conducted the face- toface the problems, it was concluded that the team work should be carried out in order to prevent the educators from being alone in the preparation of the training programs, especially the organization of the educational environments. Of course, the realization of all these will become possible through the revision of educational policies. As a result of another study conducted by Özkan et. al. (2010) they stated that it was recommended to take measures by addressing the deficiencies in the education in eightyear uninterrupted education in primary school conducted face- to- face interviews with 57 educators for this purpose. As a result of the interviews, it was frequently emphasized by educators that the children who received inclusion education has problems at the second stage after the first stage of the primary education was completed. As a result of the problems experienced in the physical infrastructure and the lack of structuring of education policies, they determined that there were disruptions in the education of children with special needs. However, it is known that successful results can be obtained as a result of structuring education policies for children with special needs.

Dağlıoğlu et. al. (2017) investigated the roles of educators in the success of gifted children. They concluded that educators used activities, positive reinforcements and different teaching methods and techniques to increase the interaction among gifted children for increasing their academic successes in inclusive preschool educational environments. Competences of the educators are as important as their positive opinions for the success of education. As a matter of fact, İlik and Sarı (2017) conducted a study to determine whether inclusive education applied to educators affected their opinions before their application. As a result of the study, it was determined that there were problems in inclusive education applications due to the problems in educators about inclusive education after the training. In addition, another result was the opinions of the educators expressing that the inclusive education did not reflect the reality.

Today, the migration has brought forward the inclusion of educational activities. Every year millions of people and therefore children come to different countries, having to leave their own countries (Tok and Korkut, 2010). In recent years, Turkey has rapidly between countries of immigration. This situation brings the educational problems of children coming through migration. Kotluk and Kocakaya (2018) in Turkey as a result of research carried out to determine whether the cultural values of the sensitive training how to apply, although many children who need inclusive education services, they concluded that there is insufficient training activities. Ira and Gür (2018) to examine the education of children who came to Turkey in case studies have determined the opinions of the Faculty of Education members. In Turkey, where the results of the research problems related to inclusive education teaching the importance of structuring infrastructure and education policy have reached the conclusion that highlighted by the members.

Especially migration results from research done in Turkey is to examine the educational activities for children. In the study by Akyeşilmen (2014) entitled as PANEL analysis and prepared based on democratic education developed by Elizabeth Bachman and Bernard Trafford, it was aimed to determine the consequences of PANEL analysis for inclusive education. Participation, accountability and transparency strengthening of the prohibition of discrimination and direct linking with human rights were defined as the components of PANEL analysis and it was stated that all of these components were features that should be considered in inclusive education. A study was conducted by Tüzün (2017) in order to investigate the education of Syrian children in Turkey whose number has been increasing every day. Tüzün, who examined the workshop conducted with the partnership of European Liberal Forum and Friedrich Naumann Foundation in Istanbul in 14-15 October 2017, stated that the current education of Syrian children were examined and then explained the necessary conditions for the investigation of these children into Turkish education system. It was concluded in the workshop that there were problems in legal status and school enrollment procedures, classrooms and level determination procedures, compensation facilities, physical capacities of schools and classrooms, safe and free access to school, discriminatory practices and poverty areas in Syrian children. In addition to the inclusion of children in the education system, recommendations were made about solving problems such as immigration, employment, fighting with the subjects like discrimination, racism by the society, making arrangements towards the interests and requests of refugee children, determining the goals for developing education policies covering all children, focusing on education practices supporting multilingual and intercultural dialogue, ensuring cooperation with the family, diversifying the provision of conditional education, providing psychosocial support to reduce the impact of the trauma experienced by a children. Özcan (2018) conducted a study about the education of Syrian refugee children whose number has been increasing in recent years in Turkey based on "Multicultural Citizenship" theory of will Kymlicka. He stated in his study that inclusive education studies including refugee children were initiated by the Ministry of National Education (MEB) as from 2016- 2017 academic year and associated this situation with a tolerant and multicultural policy of Turkey towards Syrian people. He stated that MEB planned to give intensive Turkish lessons for these children and to give multidirectional inclusive education with Arabic and culture courses they added into the curriculum as elective courses. Also, he stated that decisions were taken regarding that the field education would be given by considering the individual differences of the children and studies would be conducted for the prevention of discrimination.

#### **Requirements for a Successful Inclusive Education**

An analysis of research conducted for inclusive education in the world and Turkey, it is observed that given the importance of inclusive education. However, although the importance of education is believed, there are some deficiencies in practice. These deficiencies are the inclusion of education in a normative system, the opinions of the administrators, teachers and parents and the problems arising from the infrastructure. In order to minimize these problems, it is necessary to implement applications for inclusive education. With inclusive education, all individuals will be able to benefit from the right to education, which is the most basic human right. A number of recommendations have been developed to minimize the problems expressed. These recommendations are given below.

First of all, letting the society to believe in importance of education and turning inclusive education into a policy can be considered as the first and perhaps the most important step (Akyeşilmen, 2014; Bualar, 2016; Danforth, 2016; Tchintcharauli and Javakhishvili, 2017).

After this first step, school administrators need to believe in inclusive education and its benefits and provide efforts in this field (Emam, 2016; Engelbrecht et.al. 2017).

Of course in parallel with the administrators, there are a number of properties required to paid attention by the educators conducting the practice in order for the system be successful. Educators should move away from their prejudices and believe that every child can be successful with support. Besides, it is also important for educators to determine the interests, abilities and needs of children in their classrooms, to know how to motivate them and to realize their educational activities accordingly (Dağlıoğlu et. al. 2017; Darrow and Adamek, 2018; İlik and Sarı, 2017; Özcan, 2018; Tamayo et. al. 2017). For all these to happen, educators should have positive opinions on inclusive education (Ahsan and Mullick, 2013; Florian et. al. 2010; Mockey, 2014; Monsen et. al. 2014; Sandhu, 2017). In addition to positive opinions, it is also important for educators to accept children's differences and to fight with the difficulties that may arise from these differences (Ford, 2017).

The family is very important in the education of the child. The family which is the institution where the child starts the first education does not lose its effect as soon as the child starts his/her education life and plays an equally important role in learning of the child with the school (Keçeli-Kaysılı, 2008). For this reason, the participation of the family in inclusive education activities, the establishment of school- family cooperation will increase the success in education and may have positive effects on the development areas of the child (Llorens and Blair, 2017; Malakar and Sakia, 2017; Sakız, 2016; Srivastava et. al., 2015; Stanley and Lucas, 2008).

Educational environments need to be organized properly in the success of inclusive education. Educational environments that will be pre-

pared and enriched in accordance with the individual interests and abilities of the children will also help to actively participate in the learning life of all children (Reis and Renzulli, 2003), and the warm educational environment in the desired direction will provide a safe atmosphere (Kaputa and Charema, 2017). In addition to a warm and safe classroom atmosphere, using question- answer method providing information with drama studies and benefiting from interactive games instead of direct instruction in teaching methods are also among the methods to be utilized in the success of inclusive education (Fink, 2017; Kılınç et. al. 2017). It is also important that children are motivated and given responsibility to take more responsibility in their learning environment (Malakar and Saikia, 2017; Srivastava et. al. 2015; Stanley and Lucas, 2008).

Besides all these, it is stated that the theoretical and practical information about inclusive education is given to the educators abroad during their education in the success of inclusion education and the ease of transportation is provided after graduation for people who are specialized in inclusive education (Sharma and Das, 2015)

### CONCLUSION AND RECOMMENDATIONS

Education is one of the important forces for a society to take a healthy step towards the future. Education is also one of the most fundamental human rights. It is also known that unfortunately, education which a guaranteed by the law and should be given equally and fairly to all individuals in the society regardless of race, ethnicity, socioeconomic status, language and special needs cannot be delivered to everyone at the same rate. In the prevention of such injustices, the most focused subject in recent years is inclusive education. Inclusive education means that everyone in the society can get education regardless of race, language, religion, ethnicity, color, special needs. Through the education to be organized according to the expectation and also the structure of an expected and developed society can be established. It is obvious that inclusive education should be expanded considering the importance of a successful inclusive education. Therefore, it is possible to offer following recommendations.

Conducting awareness studies on the importance of inclusive education to everyone in the society,

Developing a policy for inclusive education by the government upon taking necessary steps for this education,

Ensuring that the school administrators should be open to the necessary initiatives for inclusive education and make efforts to complete their deficiencies,

Placing professionals who will carry out teamwork in schools and

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making efforts to make everyone believe in team spirit,

Ensuring that the educators should move away from their prejudices continue their educational activities by considering the individual differences of the students in their classes,

Taking initiatives by the educators to help the students to take responsibilities while conducting educational activities,

Using different methods and techniques during educational activities,

Ensuring that families participate in educational activities to ensure cooperation with the family

This study was limited to refugee children with special needs. Container for children in the world under the umbrella of training and examination of proposed activities in Turkey

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# PERIOPERATIVE PRESSURE INJURIES: RISK FACTORS AND RISK ASSESSMENT

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A pressure injury (PI) is localized damage to the skin and underlying soft tissue, usually over a bony prominence or related to medical or other devices (Edsberg et al., 2016). PI, which is accepted as a quality indicator in health institutions, also it is is a significant health problem that affects the patient and health care system, prolongs hospital stay, and causes economic costs (Souzani et al., 2006; Chaboyer, at al. 2015; Gencer & Özkan 2015). The main groups at the risk of developing PIs include patients with spinal cord injuries, elderly patients, hospitalized patients, and patients admitted to intensive care units (ICU). PIs are seen as more common in patients with paralysis, elderly, bed-dependent, wheelchair-dependent patients, ICU and, patients who are unable to change their positions. Also, PIss common in perioperative patients, is a significant health problem affecting the quality of life adversely, causing pain and leading severe financial losses (Spuce, 2017).

According to NPUAP, the most critical factor in the development of PI is pressure. Different tissues are affected by pressure at different rates. This is due to the tolerance of tissue, the intensity, and duration of the pressure. Age, dehydration, protein deficiency, corticosteroid use, stress, temperature, blood pressure, drug use, existing diseases, and smoking are factors that affect tissue durability (Vanderwee, 2007). Another factor is immobility, caused by the inability to eliminate the pressure exerted on the tissue. Patients with low mobility cannot change their body positions on their own, and tissue perfusion is disturbed in areas exposed to pressure, making wound formation easier (Shahin et al., 2009). Moisture can weaken connective tissue, making the skin more susceptible to pressure ulcers. In the epidermis layer exposed to moisture for a long time, first softening occurs, and then tissue integrity deterioration occurs. Moist skin adheres to clothes or bedspreads, causing scissors, creating a risk of developing a pressure sore. Moisture on the skin, discharge, sweating, vomiting, incontinas, oxygen, and discharge from the wound can be caused by (Uzun, 2010; Walton, 2009).

Also, factors can be evaluated as an intrinsic and extrinsic factor in the development of PIs. Intrinsic and extrinsic factors presented in Table 1 for general PI risk.

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Intrinsic factors	Extrinsic factors	
• advanced age,	• intensity and duration of pressure,	
• immobility,	• friction,	
• dehydration,	• shearing, and	
• comorbidities,	• maceration (i.e., tissue softening in	
<ul> <li>impaired sensory perception,</li> </ul>	the	
<ul> <li>altered tissue perfusion,</li> </ul>	presence of moisture or liquid).	
• malnutrition,		
• anemia,		
emergent admission to an ICU		

Table 1. Factors for PIs

#### **Perioperative PI**

Perioperative patients are at risk for developing pressure injuries because they can experience intense or prolonged pressure during lengthy surgical procedures, may have increased pressure on bony prominences from positioning, are exposed to friction or shear during transfer to the Operating Room (OR) bed and positioning, and often have significant comorbidities.

A systematic review of 17 studies published from 2005 to 2011 that evaluated the incidence of these lesions found results ranging from 0.3% to 57.4% (Chen, Chen & Wu, 2012).

#### **Perioperative Risk Factors**

Patients undergoing surgery are at risk for pressure injury development due to extrinsic and intrinsic factors. Patients are immobile and unable to change their position. They cannot feel the discomfort prolonged pressure causes because of sedation and anesthesia (Nilson, 2013).

Surgical positioning affects the risk and location of skin breakdown. The fact that the patient is in the same position for a long time in the operations is the most critical factor that increases the risk of developing pressure sores (Nilson, 2013). The incidence of perioperative PI derived from surgical positioning and found the following rates: 12.2% in Portugal (Mezenes et al. 3013), and 12.7% in Italy (Bulfeno et al. 2012).

The duration of the procedure is also an indication of the time the patient exposed to pressure. Studies show that as the duration of the surgery increases, the incidence of pressure sores increases (Nilson, 2013). The perioperative risk factors detailed in Table 2, as preoperative, intraoperative, and postoperative.

Preoperative Risk Factors	Intraoperative Risk	Postoperative Risk
	Factors	Factors
-spinal cord injuries,	-friction,	-use of
-previous pressure injuries,	-shearing,	-vasopressors,
-skin problems (e.g., blisters,	-multiple surgeries,	-mechanical
bruising, redness) in areas at	-extended length of time	ventilation,
risk for pressure injury,	in the OR,	-administration of
-hemodialysis,	-use of positioning	sedative
-creatinine level greater than	devices,	-medications,
3 mg/dL,	-use of anesthetic	-corticosteroid use
- albumin level greater than	agents, sedation,	-length of stay longer
3 g/dL,	-vasoconstrictive	than three days,
- limited mobility,	medications,	-extended time in the
- fecal incontinence,	-instrumentation,	intensive care unit.
-anemia,	-type of surgery (e.g.,	
- malignant tumors,	cardiac),	
- low weight or body mass	-body temperature (i.e.,	
index,	hypothermia),	
- presence of pain or inhibited	-low arterial pressure.	
sense of pain,		
- low hemoglobin level,		
- infections,		
- poor nutritional status,		
-American Society of		
Anesthesiologists Physical		
Status Classification score of		
3 or greater		

Table 2 Perioperative Risk Factors

#### **Risk Assessment**

Although PI, which is one of the most critical indicators that reveal the quality of nursing care, can be prevented by simple nursing interventions, it continues to be a problem all over the world (Souzani et al., 2006; Chaboyer, at al. 2015). The high PI development in patients in the perioperative environment indicates that risk assessment and the use of protective measures should be improved (Munro, 2010). Besides, the literature shows that approximately 95% of all PIs developed in perioperative patients can be prevented by early risk assessment and appropriate interventions (Spuce, 2017; Peixoto et al. 2019). In patients undergoing surgical intervention, since the surgical intervention is in the foreground, risk factors that may lead to pressure wounds and, therefore, prevention interventions are mostly not paid attention (Gül 2014; Gao et al. 2015). Prevention of pressure injuries is possible by evaluating patients at risk first. Risk assessment should be made with accurate, reliable, and risk identification scales that determine risk factors (Soyer & Özbayır, 2016; Spuce, 2017; Peixoto et al., 2019).

Perioperative patients should be evaluated in the preoperative, intraoperative, and postoperative periods. Prevention of PIs is possible by assessing patients at risk first. Risk assessment should use valid, reliable, and risk identification scales that determine risk factors.

#### **Risk Assessment Scales/Tools for Perioperative Patients**

The use of assessment scales/tools that include internal and external risk factors for the emergence of injuries can help the perioperative nurse to identify patients at higher risk (Lopes et al. 2016; Spuce, 2017).

Although validated PI risk assessment scales are available, the majority of these tools do not focus on pressure-related skin injuries specifically acquired in the OR (Engels et al., 2016). In PI risk assessment scales, the Braden Scale is the highest validity and reliability (Engels et al., 2016; Celik et al., 2019). However, the Braden Scale has limited use for patients undergoing surgery because it does not capture critical risk factors related to surgery.

**Munro Scale:** The Munro Scale uses a cumulative score to evaluate factors in preoperative (e.g., mobility, body mass index); intraoperative (e.g., American Society of Anesthesiologists score, body temperature); and postoperative (e.g., length of perioperative duration, blood loss) care (Munro, 2010; Spruce, 2017).

**The Scott Triggers tool:** The Scott Triggers tool assesses the patient's age, albumin level or body mass index, American Society of Anesthesiologists score, and estimated length of surgery to determine whether the patient is at high risk for pressure injury (Spruce, 2017).

**3S intraoperative risk assessment scale of pressure sore:** The 3 S scale assess; the condition of the skin on the whole body, preoperative activity status, height/weight rate, stress state of the skin, surgery the amount of bleeding, duration of surgery, surgery stress, body temperature during surgery, surgery position" under the item. A four-point Likert type It is scale-items of the scale range from one to four points. Scale items scores it received from someone's total score is obtained. The score is at least nine, and at most thirty-six points (Soyer &Özbayır, 2018; Gao et al., 2015).

**Injuries due to Surgical Positioning (ELPO):** The ELPO, developed and validated in Brazil, evaluates the risk of developing injuries resulting from surgical positioning. The scale contains seven items with five subitems each. The score ranges from one to five points, and the total score from seven to 35 points. The higher the patient's score, the greater the risk of developing injuries due to surgical positioning (Lopes et al., 2016).

### Perioperative Nurses Role

All surgical patients are at risk for the development of pressure

ulcers as a result of a complex combination of systemic and environmental factors (Engels et al., 2016). Development of a PI in a surgical patient may result in increased pain, a more extended hospital stay, re-admissions, multiple surgical interventions, possible disfigurement, and increased cost (AORN, 2016). Risk assessment and skin assessment of the perioperative patient are primary factors in the prevention of pressure ulcers and entail a comprehensive approach to evaluating risk.

Perioperative nurses should know the risk factors of perioperative patients. Risk assessment should be performed for perioperative patients.

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# PERSPECTIVES ON CHALLENGES OF TEACHING FOREIGN LANGUAGE ONLINE ACROSS THE WORLD

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### Introduction

In light of rising concerns about the spread of the novel Coronavirus, henceforth COVID-19, the world is passing through these unprecedented and chaotic times. This pandemic has put the world on hold. Thus, everything in our social life is subject to experience a transformation. As the pandemic prompts countries to close their borders and quarantine people, taking strict measures, a growing number of institutions have shut down in-person classes. The virus has revealed vulnerabilities in education systems across the world. A new education system is taken shape around the globe as it is also one of the most affected areas. This pandemic beyond any doubt will affect education systems across the world for the better - and the worse - in the long term with a lasting impact on the teaching and learning. One of the crucial concerns of this shift is how and to what extent to provide students with education in a new environment via various platforms. From the point of their responses to the pandemic, some institutions have had to employ different measures for their students. Thus, for example, some of them have either extended various deadlines or added an extra vear, but some have opted to go online as education is fundamental. It is essential that those institutions thrive to maintain its sustainability. Over the course of its long history, innovations in educational have undergone a tremendous change over the centuries. Serdyukov, (2017: 4) argues that:

Education, being a social institution serving the needs of society, is indispensable for society to survive and thrive. It should be not only comprehensive, sustainable, and superb, but must continuously evolve to meet the challenges of the fast-changing and unpredictable globalized world. This evolution must be systemic, consistent, and scalable; therefore, school teachers, college professors, administrators, researchers, and policy makers are expected to innovate the theory and practice of teaching and learning, as well as all other aspects of this complex organization to ensure quality preparation of all students to life and work.

In this paper, a transition from traditional in-person education to online education is debated, the current status of transition somewhat in Turkey and across the world is provided, not only are challenges identified but also some recommendations and implications for the improvement of online education are also offered. Furthermore, how online education is being integrated into schools, universities and teaching institutions and why this type of transformation does not end up with the required results is highlighted.

#### **Current Status**

According to OECD – an intergovernmental economic organization with 36-member countries – 421 million children are affected due to the

closure of schools in 39 countries. The other 22 countries have announced partial closures (In UNESCO's COVID-19 Educational Disruption and Response). Efforts to implement distance education have started immediately after the closure of schools. Accordingly, the world's education systems have been thrust into an e-learning practice of unprecedented scale and scope because of the COVID 19. Many institutions find themselves in this state of concern and trepidation when they agree to teach a course. However, all of a sudden they experience confusion and even fear, feeling clueless about what the initial steps to be taken. "Even experienced ones feel a little nervous about teaching with the new digital device set for the first time. While many of the universities have been caught unprepared, some of them have experienced and know exactly how to prepare and teach online." (Lewis et al., 2016: 5). In the meantime, most professors/ educators and students across the world suddenly find themselves forced to venture into academic digital technology for the first time.

In many aspects, education all across the world is shifting to remote instruction. Therefore in order to carry out this transition the issue coming to the fore is the problem of how foreign language teaching strategies may be aligned with digital platforms and to what extent they may be improved in order to provide students with the foreign language skills necessary to contribute meaningfully as in the cases of in-person education. Thus, many innovative steps were taken. "While it took many centuries to develop our education systems through these old technologies, we have not yet had time to make the radical changes afforded by digital technologies" (Laurillard, 2005). Although innovations in education are of particular importance because education plays a crucial role in creating a sustainable future, it is too early to claim a digital mainstream taking over traditional education on a large scale.

However, some education institutions in some countries such as China Japan and Turkey have rapidly innovated and implemented online learning on a national scale due in part to earlier preparedness with the necessary tools, teaching approaches and considerations with online learning. Thus, this has resulted in less interruption for many students unable to return to in-person classes. Some countries made it possible thanks to MOOCs (Massive Open Online Courses) to contribute education. The courses are of varying lengths – from a few hours to a regular, weekly commitment over several months – and typically involve video lectures, reading texts and regular tests to check your memory and understanding of the syllabus. In Turkey, however, partly due to the steps taken earlier, the infrastructure was almost prepared when the pandemic broke out. As one of the important steps as protective and precautionary measures against the epidemic disease, National Education Ministry in Turkey came up with the digital

education system presented free of charge, providing a model with a television and internet-based curriculum prepared for the first time in the world on a national scale.

Another important step was that universities under the head of Turkey's top higher education started to begin providing online classes amid the global COVID-19 pandemic. For universities lacking the necessary digital infrastructure, a collaboration between the council and the Ministry of National Education has been provided. Furthermore, this applies to all levels of education and training, including undergraduate, associate and postgraduate programs. While over 1.5 billion students worldwide have been deprived of face-to-face education due to the COVID-19 lockdown, Turkey is the second country to start nationwide remote education.<sup>1</sup> Shortly after schools were shut down in Turkey, 18 million students began receiving online and TV school lessons through the country's Education Information Network (EBA) and public broadcaster TRT EBA Through EBA, the world's largest online education platform, students could access 1,600 lessons, as well as more than 20,000 interactive content, though many students could not follow the lessons initially due to the intensity. Three TRT channels were designated exclusively for primary, secondary, and high school lessons. Unlike the traditional 40-minute regular classes, the courses were planned as 20 minutes. They were planned to be broadcasted mainly through television channels, more than once throughout the day. It would not be possible to carry out this colossal program and ease the transition if lecturers and students had not been trained for online education over the past two years.

Education is the basis of society, and therefore regardless of any circumstances, and environment it must continue. Understanding about how we learn from the brain and cognitive research has resulted in more active teaching and learning strategies, no matter which environment is being used. This means a shift from traditional background to online platforms with the variety of practices as mentioned above. As Dewey (1980: 12-13) puts the point: For times of instability are times of opportunity as well. As Dewey puts the point:

Life itself consists of phases in which the organism falls out of step with the march of surrounding things and then recovers unison with it—either through effort or by some happy chance. And, in a growing life, the recovery is never mere return to a prior state, for it is enriched by the state of disparity and resistance through which it has successfully passed.... Life grows when a temporary falling out is a transition to a more extensive balance of the energies of the organism with those of the conditions under which it lives.

However, if the relevant literature is reviewed to determine how these learning environments were defined, it will be noticed that various definitions are used for online learning, virtual learning, e-learning, distance learning, and blended learning, all of which are distinctive, referring to the act of using technology in learning, but how learners engage in that process is slightly different. In what follows, various types of online learnings are attempted to be highlighted.

Online Learning:

As underlined by J.L. Moore et al., (2010: 2) "Online learning can be the most difficult of all three to define". They underscored that "Online learning is described by most authors as access to learning experiences via the use of some technology."

• Online learning is just one type of "distance learning" - the umbrella term for any learning that takes place across distance and not in a traditional classroom.

• Always involves an internet connection and it is often referred to as "e-learning" among other terms and can include virtual face-to-face interactions (webinar, online lecture, virtual meeting)

• Uses online tools for learning, such as online curriculum or virtual space or conferencing software.

• Could also be considered a mix of virtual learning and blended learning.

Virtual Learning:

It is defined as "learning that can functionally and effectively occur in the absence of traditional classroom environments" (Simonson & Schlosser, 2006). In this process, online teaching activities are carried out by means of computers and internet both outside and inside the facilities of the educational institutions.

• Instruction is delivered through the internet, software, or both.

• Can be used inside or outside the physical building of the educational organization.

• Uses the computer and an online program or software to enhance the learning experience.

• Can be used in a self-pacing format (individualized) or live web conferencing between students and instructors.

• Students have remote access to content and instructors.

• Student can connect and interact with other students and their in-

structors online.

E-Learning:

The origins of the term e-Learning are not certain. In Moore, J. L., et al. (2010: 2), it is emphasized that "as there is still the main struggle as to what technologies should be used so that the term can be referenced, some authors will provide either no clear definition or a very vague reference to other terms such as online course/learning, web-based learning, web-based training, learning objects or distance learning believing that the term can be used synonymously." However, they went on to state that but "... all forms of e-Learning, whether they be as applications, programs, objects, websites, etc., can eventually provide a learning opportunity for individuals."

• Utilizes digital tools for teaching and learning, and technology facilitates the learning process.

• Can be used online or in a classroom setting.

• Students take a course from a teacher but only interact with the teacher online.

- Students have unlimited access to the content.
- The course completion, program, or degree is distributed online.

As pointed out by J. L. Moore et al., (2010: 5) depending on the country "Not only were there inconsistencies with terms and their meanings, but also with the spelling of the term used to represent electronic learning, i.e. e-learning, e-Learning, E-Learning, and elearning."

Distance education/learning:

It has a history that spans almost two centuries. In Moore, J. L., et al., (2010: 1-2) distance education is described as "the effort of providing access to learning for those who are geographically distant." and it was referred as "an "umbrella" term.

- Same structure as online learning.
- Specific purpose is to attract students from all locations.

• Can provide instruction to someone learning in a different time and place than that of the teacher and other students.

Blended or hybrid: (Boettcher and Conrad, 2016: 11)

• Blended learning is the combination of classroom and virtual learning.

• Ideally integrates virtual learning in a way that individualizes and

enhances instruction for students.

• Uses technology to facilitate what is essentially a face-to-face course.

• Uses a course management system to post the syllabus and assignments and lectures. Similar to face-to-face courses.

Homeschooling:

• Also known as home education, is the education of children at home or a variety of places other than school.

• It can be defined as the practice of part or all of the education of children in the age of compulsory formal education by the people who are in the family or family-appointed.

• Home education is usually conducted by a parent, tutor, or an online teacher.

By taking into account the given definitions, the description of those types of learning/teaching has been shifting over the last twenty years as technology has been changing the nature of education for years. When making definitions, we should keep in mind that these terms interchange when describing the learning environment. Adiyaman (2012:92) argues that:

The most important reason for this definition change is the developments in the field of educational technologies. Distance Learning, it removed all the borders and walls in education. In other words, distance education is the one who wants, at any age, it provides the opportunity to learn using the desired environment, at any time. Distance, time, place, age, socio-economic situation, physical disability, etc. features distance education, lifelong keeps learning constantly on the agenda.

These courses are shifting to regularly include synchronous online meetings<sup>6</sup>. However, different around this - some are specifically talking about shifting to online education, while others talk about remote classes and the like. This online teaching/learning has not appeared out of the blue. Research about teaching practices for online and blended courses has been proceeding concurrently with the development of voice, video, and mobile technologies and digital resources for many decades now. Online courses as we now recognize them first started being available in the early 1980s.

Serdyukov, (2017: 14) maintains that "any integration of technology in teaching and learning has to demonstrate an increased productivity of teaching and learning, but it can be achieved only when applications are based on an effective pedagogic theory. Technology innovation will eventually drive pedagogic innovations, without a doubt, however, this path is slower, more complicated, and leads to an enormous waste of financial, technical and human resources."

#### Do these challenges exist today?

Certainly, many of these issues are present. Historically, there have been various challenges that have left distance learning inferior to its in-person counterpart: difficulty in catering to learning styles, changing the presentation to suit the audience, inability to control the pace and progress of the course, and many other hurdles. As mentioned above concerning the pros of online education, there is also obvious further scope. The biggest challenge has always been a substantial lag in communication. One of the core necessities of effective learning is the ability to have two-way communication between the instructors and the students. Since the start of distance education, this continued to be a problem through the many attempts of creating effective learning programs, and created a canyon between teachers and students. How can a student expect to learn if they have no effective way to voice questions, comments, and frustrations?

The last report of OECD (Organization for Economic Co-operation and Development) mentions that technologies are not sufficient to support teaching and instructional purposes. They are simple tools in the hands of teachers and it depends on them to take good use in their activities. Yet, our society is "not yet good enough at the kind of pedagogies that make the most of technologies (OECD, 2015). Adding 21<sup>st</sup>-century technologies to 20th-century teaching practices will just dilute the effectiveness of teaching" (OECD, 2015, p. 3). This is the reason why we choose to analyse the technology acceptance of teachers and the practices they develop.

In Lewis et al., it is maintained that "Not only do virtual schools grapple with providing teachers the professional development needed to tackle the pedagogy required in an online environment, but also they fight to help credit recovery students who struggle with the freedom to work at their own pace and the responsibility of time management" drawing attention to the dilemma both for teachers and learners (Lewis et al., 2014: 4).

Online learning is very important not only to recover from crisis periods, but also for those who cannot reach educational facilities in big cities. The benefits are undeniable: reduced costs, great flexibility for the student and the ability to train thousands of people all over the globe at the same time. That said, the motto of online education, "Any time, any place, any pace" is extremely seductive. However, e-learning is not without its faults. Despite the benefits of online teaching and learning environment, students taking online courses could face difficulties that they might never have encountered in a traditional teaching and learning environment and these difficulties could have a negative impact on their learning performance.

Online training comes with its own particular characteristics, which can jeopardize (or, limit) the success of the training. As Serdyukov (2017: 17) points out that "Innovation is difficult to spread across school and academia because it disrupts the established routine and pushes implementers out of their comfort zone." Moving from a campus face-to-face environment to an online technology platform can be intimidating and challenging. Adapting lifelong teaching habits to a new environment takes time, energy, patience, and a willingness to try different teaching strategies using digital tools. Instructors who are new to online teaching need many kinds of support, from technology to course design to simple encouragement. Although all the countries and their university's administrative staff for working "tirelessly, around the clock" to provide training sessions on how to use the site, but how realistic is it to suddenly shift large amounts of teaching online?

The more controversial question is: How hard can it be? A common practice for teaching in the face-to-face environment is to use the syllabus and notes from someone who has taught the course before. For a new course, the strategy is a bit more complex. As Boettcher and Conrad, (2016: 5) argues "The instructor must determine the goals and learning outcomes for the course learners, explicitly define the content of the course, review textbooks or resources that map to the learning outcomes, order the resources (probably a textbook), and plan the assessments and assignments and experiences so that students achieve the learning outcomes. Thus, some questions raise concerning "which of your face-to-face teaching strategies and behaviors will work well in the online platforms and what new behaviors and strategies you need to learn for this new platform as everything seems new." (Boettcher and Conrad, 2016: 5).

Things do not always go as expected

This crisis reveals the importance of schools. In this unforeseen and unpredictable landscape, technology has offered credible solutions to an unprecedented problem. The online tools and upgrades to existing technologies that have been pushed to the forefront of university teaching will emerge important platforms all across the world. Hard evidence for the superiority of the classroom to the online experience is actually scarce. In Boettcher and Conrad (2016: 4), it is argued that "Teachers who are effective in the face-to-face environment can be effective as online teachers, but it is not automatic, and it does not happen overnight." Face-to-face interaction will never be matched in quality by other modes of communication. Although distance education may be an appropriate method for overcoming the current crisis and sustain educational activities in the city, there is no doubt that it comes with certain problematic areas requiring to be handled by all providers. The burden of shifting to teaching online can be difficult for even the most experienced teachers. Even for novices. Young generations are already getting used to this system as they live an online socio-cultural life across the world, but the real challenge comes with the elderly. Efforts to keep students engaged are particularly important in an online environment since distractions are just a click away. We find that it is rarely necessary for us to speak for more than 2-3 minutes at a time and try to keep your talk time down. You cannot do everything on a mobile phone. You cannot just go to the library or find free Wi-Fi.

In underscoring the challenges, Ertmer (1999) argues that there are "as external (first-order) and internal (second-order) barriers. The first-order barriers are purely operational (technological), while the second-order barriers are applicational (pedagogical)."

#### Challenges

Given that many institutions all around the world are struggling to carry out online courses, it is now disappointingly noticeable that many of those institutions do not have such contingency strategies in place and do not have great infrastructure or assets to build effective online courses rapidly rather than wait and watch plans. Integrating online technologies into your teaching can be a challenging prospect, and it can be difficult to know how to approach it effectively for the benefit of both teachers and students. No matter what type of technology you employ in your teaching or learning experience, you will face some sort of problems on your digital teaching approach. Many teachers unquestionably have concerns considering complications evolving from the rapid shift to sudden, forced adoption of online delivered instruction as well as ethical concerns. Thus always be prepared for something to go wrong.

Aspects like the number, quality, teaching experience, technological competence, and distance-learning-related knowledge of the instructors are significant in implementing such classes. The most common problems related to distance education; technical issues such as disconnection; teacher and student-centered issues, like inability to focus on education and inadequate educational content will be attempted to be highlighted below. For example, Yaman argues that (2015: 978)

Although distance education appears to be a popular means of education in a number of fields in recent years, the actual efficacy to be reaped is determined by the specific conditions at hand. Its current practice at Turkish universities, for example, does not possess a standard and well-programmed style. While some universities offer distant English classes only through asynchronous lessons, some others support these asynchronous lessons with regular synchronous sessions.

However, Al and Madran, (2004) argue that "in addition, applications carried out only with asynchronous lessons must be used with synchronous lessons and supported by regular teacher-student meetings, and therefore the fact that the interaction dimension is not ignored is one of the sine qua non of this process."

For university students, the most common problem is the problem of disconnection. Time management is highly important and is another important challenge. When teaching online you really have to use your time wisely. People do not want to stay in one spot online about a few hours. Spending a lot of time on the computer will definitely bring about distractions. Besides, from the point of institutions, how much time per day to attempt to connect live with students is another significant issue. Time Zones are another elements given the large scale of this education. Technical problems can also be really frustrating, but you do not have to worry as students usually comply with it. Due to power cut, cancelations may take place.

Besides, unlike traditional in-person classes, it is harder to interact with students online as many factors are involved. The other biggest challenges is that unlike physical classrooms online is a very different space as it is a different experience. However, teachers do and try what they have done in in-person classrooms. Without face-to-face contact, teachers are not able to pick up nonverbal and behavioral cues from students that might indicate the students are disengaged, frustrated or unenthusiastic about participating. Levels of engagement and attention is very different. Thus, people tend to behave differently in this space. In terms of encouragement, teachers also cannot share their emotions easily with their students and may find it harder to express their enthusiasm, or give encouragement, or show concern. The other issues are types of course and student's motivation. Lack of engagement and motivation is one of the main reasons e-learning courses fail. Another important challenge is for students with identified exceptionalities, such as Attention Deficit Disorder as they have to sit there and they do not have the changing activities that one would have in a teacher taught classroom.

The other problematic area is when dealing with language courses, teacher faces the difficulty in explaining related subjects, grammatical concepts can be hard to explain sometimes, but some programs such as Google can come in handy and online dictionaries, pictures and actions are great ways to explain new vocabulary.

Having said that, the transition to online education may not be as appealing as it seems because it poses some risks for job losses and decreased tuition revenue. It is possible that decline in lecturer positions will take place. Some teachers/professors across the world may be displaced. There is also the increasing possibility of long-term impacts related to future budget constraints.

These challenges ranging from technical problems, teacher and learner related issues can be divided into some categories as follows:

#### **1-Technical Issues**

Taking the issue in terms of technical aspects, while the educators had been employing the digital classrooms all over the world over the past many years, its slow pace was frustrating. Thus, most teachers and students across the world were hesitating to adopt it.

For example, from the point of technical issues, both teachers and students encounter technical difficulties. Using the platforms such as Zoom, Adobe, Microsoft and others may require taking a little time and being a bit careful about how adjusting those online programs meeting platforms will not be easy for many teachers. Therefore, it is always possible that something during these courses/sessions will go wrong. Nothing can ruin an online class like a bad audio connection from a teacher. If you are someone hard to hear, then everything can fall apart. Problems arising from sound, camera, headphones/headset, computer, and internet connection will upside-down everything. Using a microphone is crucial. You pick up a lot of audio from background noises unless you do this. This of course may include your kids or pets or anyone working from home. If you place your microphone too close to your mouth, learners will probably hear a lot of breathing. On the other hand, if the mike is too far from your mouth, you may sound like you are really far away. However, if you do not speak up, your voice will not come through clearly, turning up the volume will be useless. Students without a microphone or earbuds can have audio related problems such as they can hear all of their background noise when they are talking. Besides, you may have connection cuts consecutively, which may spoil all the course. In the meantime, muting is also important, if students do not mute, then you can have noises overtake the main speaker. This is because educational technology is not simply a miraculous device that does a wholly predictable.

The enforced pace of the online switch in the world has not always made that easy to achieve, though. Constant internet stream, live broadcasts that happen on the infrastructure, hardware, software, make it difficult for providers to constantly keep and sustain their existing content..

Anyone who has ever tried to set up a Zoom meeting knows that there are inevitable technical and scheduling problems when trying to link up 30 people, much less 30 million. Indeed, huge domestic technology firms

even can experience crashes after receiving tenfold jumps in traffic. Poor internet connection, let alone 5G technology becoming more prevalent and power outages and difficulties in logging in for students from anywhere are among the most critical problems concerning e-learning.

Last but not least, putting courses and exams aside that is., everything related to online system and your personal information may subject to cyber-attack. In other words, all of a sudden your live online course may end up anything. Thus, the digital shift has suddenly thrust universities search for a technical team of experts so as to deal with the problems discussed above.

Boettcher and Conrad (2016: 64) maintains that "It's inevitable that sometimes technology does not work as it should. Be ready to postpone or adjust a test, an assignment, or an expert event until the technology is available. For example, if a technology interruption is impacting assignment submissions, allow students to submit their work later, or in another way— by e-mail, text, or blog. Above all, assure students that their grades will not suffer because of the technology failure. Also, be open to solutions they may propose. This will help everyone relax and stay focused on learning tasks, not the technology glitch. Another element of providing technology choices is making certain that essential technology tools are readily available and affordable for learners. Sometimes it makes sense to let learners choose their favorite technology for producing important course products so they do not have to lose learning time using a course-mandated tool they will not be using again. The quality of learning is heavily dependent on the level and quality of digital access. The best key to success is adaptability and flexibility.

#### 2-Problems from the point of teachers and learners

From the perspective of English language instructors and students many aspects arise. "It is especially teachers who shape students' learning environments and help them reach their intellectual potential" (Vieluf et al., 2012: 113). Having said that, some of the teachers are not technically savvy and unaware of what to do with unexpected or even challenging technical incidents. You may even end up having a lecture with your microphone turned off in order to catch up the course on time. Instructors' not being able to use the necessary tools and software will probably end up with loss of motivation. Having problems getting feedback from the students, difficulty in handling classes giving appropriate grammar corrections and feedbacks are also other concerns.

As discussed in (Al and Madran, 2004), teachers should have to some extent basic skills to use this system, they argue that:

Because distance education is defined and managed by users, preparing course contents, managing lessons, opening student-specific programs, assigning and delivering assignments and projects, preparing and applying exams and tests, monitoring and analyzing student behaviors, evaluating students' achievement status and finally interactive communication environments. It is a comprehensive system that should include the processes of creation and management.

Teachers were somehow taking steps to solve some problems (if faced) in traditional classrooms. On the other hand, with online education, teachers started not to follow in any way, as the responsibility was only students. The follow-up of the children who are left alone at home is completely at their own initiative.

Yaman (2004: 976) argues that unlike traditional classes, online classes of not provide an efficient background for language teaching and activities, comparing English with other courses, maintains that:

English courses are quite different from other courses in nature. Your teacher in history lesson it is understandable that they are more active and students are a little more passive. But in the English class phrases effectively for the student to improve their language skills even at a low level, and writing paragraphs, practicing words, making oral essays on pronunciation is necessary. This is the homework that he has accompanied by the instructor in a face-to-face environment. It is possible thanks to its controls and feedback.

Another aspect is that teachers generally use the computer or other electronic devices only for preparing exam questions, writing purposes, and using social media; thus it is highly likely that they face the deficiencies in the use of technology in this process.

Ekici (2003) revealed that as in-person education, the teacher is constantly interacting with the student, he/she has the opportunity to get to know the students soon and can take flexible steps towards individual differences when and where necessary. Considering individual differences in distance education, however, is not so easy to identify.

Another concern to be addressed is the assessment and evaluation process. Since different skills are involved in teaching foreign languages, the classic assessment and evaluation methods for the evaluation of students within the scope of language courses may not be enough as it involves various reading, writing, listening and speaking skills. Thus, evaluation only by multiple-choice tests in the distance education system will not result in success.

Internet quotas and lack of computers are another important challenges for students, though students were all provided with a small amount of

free internet gigabytes in Turkey. Another concern is that students can still find it hard to focus when they are surrounded by the distractions such as coolers, refrigerators, siblings and other home comforts. Furthermore, it is possible that some students may play games in the background. Besides, regular absences, except under exceptional circumstances, can lead to failing a course. Time management is the top challenge that teachers have when having classes online. Online teaching necessarily may not the best approach to use, especially in the younger learners as they do not have the attention or the executive function skills to be able to sit and learn online for hours every day on their own.

However, the students are expected to have somewhat readiness and to some extent some pre-knowledge in order to attend the distance learning system. Here, digital divide can be a real issue for the students' access to the internet, because online learning implementations today are mostly internet-based. In addition, during the teaching/learning process of a language some inevitable concerns arise with respect the development of language skills. In other words, active participation, conversations, interactions, writing essays and readings are required to achieve the aim in the target language. However, unlike in-person classes, efficacy of distance education for language teaching and learning in providing those goals properly is under the discussion as the aspects mentioned in this paper.

In traditional classes, the students are used to seeing us standing up in the class. On the screens, your image will likely be the first thing students see when they log in. Therefore, they may claim that online class is not as serious as the courses are occurring at home. Another problem will arise during non-verbal communication. There will be chaos if we do not set a few standard forms of non-verbal communication as everyone is responding to what is being said at the same time.

In the study conducted by Lewis et al., (2015: 149), it is maintained that "students wrestle with several challenges, including lack of motivation and lack of experience, and that these challenges can often be overcome with the additional support of a face-to-face teacher and the individualized nature of the online environment." Over the course of time, you will find that first enthusiasm disappear with less discipline. Besides, lack of routine and time is often the biggest challenge. To prevent this try to set up a schedule and in order to keep motivated, handle it with like a physical class and keep up with the change. Furthermore, make an effort with the class exercises and homework and try to complete the course in full.

While the assumption is that most students have a laptop to do e-learning, there is always a small number who do not. However, there are students who cannot meet the cost of digital devices and data plans. Given the digital divide, new shifts in education approaches could widen equality gaps. This should be ensured that no one will be left behind in the transition from face-to-face to e-learning.

Another problem is that digital contents and teaching materials such as presentation and lecture notes may not overlap with the purpose of the course, and thus some students may get the impression that the course contents are based on the "cut-copy-paste" method. The students also may claim that some of their teachers are unable to use technology well. This may not end up with satisfaction of their teachers' attitude. Last but not least, whether this system will work for the disadvantaged students is not known yet. As the online learning platform is both for teachers and students, having a class without setting expectations will probably bring about the problems mentioned above.

Due to the technical problems compatibility issues may appear such as operating systems, browsers or smartphones, thus the courses never get off the ground or the student does not know how to continue. In addition, having a weak internet connection will make all aspects of the online interaction difficult. In the end, this lack of ability adds to their frustration and reduces employee engagement, the learning experience is disrupted and they will probably abandon the course.

In Lewis et al., (2015: 151) it is argued that "More than half of the students in each case study shared their feelings of being ill-prepared to take classes in the online environment and that they received little or no support prior to beginning an online course. Several noted the need to depend on a parent, relative, or friend for help in this new learning environment." Thus, some assistance on online tutorials on web tools is required for those learners who are unfamiliar with the online environment. As stated in the UN-ESCO report, "Students are much more likely to learn to solve real-world problems and collaborate productively with their peers, for example, if their learning activities are carefully designed to offer opportunities for them to do these things. This finding suggests that professional development for innovative teaching might begin with lesson design" (UNESCO, 2013).

As discussed in Lewis et al., (2015:149) "students having navigation issues or being unfamiliar with the format of the online class. They noted that students struggle with reading directions, internet downtime, and not having taken an online class in the past... not having any prior preparation or training before taking a class in the online environment... mentioned not having access to textbooks that align with the course and expressed student frustration and a lack of understanding when their online teacher's availability did not align with their own work time."

Lewis et al., (2015:151) addresses the challenges of online learning for students with identified exceptionalities, such as Attention Deficit Disorder as well as the visually impaired students.. For example, "They have to sit there and they don't have the changing activities that one would have in a teacher taught classroom where we're going to chunk and do this for 15 minutes and then 20 and then 45."

The reality, however, is that the majority of districts, students, and teachers are not prepared for the changing digital landscape and that gaps exist among students and schools within districts that offer online learning as an option (Watson et al., 2014)

#### 3-From the point of the institutions

Due to the lack of clear plans about how they will provide certain services to students, institutions will face problems to some extent. Besides, updating their existing plans yearly and discussing how such plans can be improved upon based upon available research on how best to use technology is required.

Preparing and adopting the contingency plans by the governments should be put into practice without delay when institutions have to close due to this crisis. However, some institutions have struggled with accommodating the rapid switch to online learning. Universities use different methods according to the number of infrastructures and students, and while some of them provide distance education simultaneously, some share the course content they upload to the system.

A big consideration for institutions making this transition is how much time per day to attempt to connect live with students — known as "synchronous", or real-time, learning — versus putting out assignments for students to complete on their own — known as asynchronous learning. In this process, which was initiated, the points such as whether the infrastructure of each university is ready, the content of the education, the ability of the educators to use this technology, and the students' access to the courses are also discussed.

Another issue is the technical competence of the smart classrooms for teachers to shoot video courses or live stream their classes. Constant internet stream, live broadcasts that happen on the infrastructure, hardware, software, make it difficult for providers to constantly keep and sustain their existing content. Training of lecturers is required and establishing schedules and standards for the online lectures, and markings attendance for group classes are also important. In order to bridge the digital divide, it is necessary that the institutions should negotiate deals with several network providers to subsidize the data plans. To help learners lacking the internet and who cannot meet the cost of digital devices and data plans, it is recommended that governments decrease costs and make digital classrooms affordable in order to prevent the digital divide. Furthermore, those institutions should provide guidance about working remotely, including communication devices, and protect against cyberattacks.

Considering all these challenges, some implication and suggestions are provided as follows:

#### **Implications and Suggestions**

Many students all across the world are stuck at home. As a result they have a limited range of social contact and their lives have been turned upside-down. What is needed and urgent right now is to make them feel that life is continuing and some feeling of normality. Thus no one wants to have learning coming to a halt. The underlying problem is: How can we assist them and also us to have a mental break from everything else going on in this crisis? How can you connect with the students? How can they connect with each other? And to what extent will we push yourself in each lesson?

As Serduykov (2017: 8) argues that you need various stakeholders for a successful innovation in education:

Educational innovation concerns all stakeholders: the learner, parents, teacher, involvement and support. When considering the learners, we think of studying cognitive processes taking place in the brain during learning – identifying and developing abilities, skills, and competencies. These include improving attitudes, dispositions, behaviors, motivation, self-assessment, self-efficacy, autonomy, as well as communication, collaboration, engagement, and learning productivity.

Apart from teaching staff who needed training, students were also provided with guides to use the tools, and on getting themselves ready to learn in an online environment. As known that teachers are modelling how to respond to change. By illustrating your presence to them regardless of the background conditions is really important No matter what happens in lessons as mentioned above, however much technology does not function properly or the course does not go to the planned schedule, students will be encouraged with your presence, providing feeling a sense of success together.

As students move online all across the world, it is inevitable that they might need a bit more guidance as institutions set up activities. People all need to take the time to go through it, to make sure students understand it and set up the meetings and the settings with intention. Instead of employing various technologic items, keep it simple, that is., stick to the tools

that you and your students are already familiar with when you are starting out, and stay within the online platform for whatever you can. Including a variety of eye-catching activities and techniques in courses will attract students' attention more and prevent students from distractions. Revising your syllabi, setting up course homepages and uploading required readings are the initial steps to be taken. Some activities can be with cameras and/ or microphones on, some with them off. Writing, speaking, reading and listening skills can be performed in pairs, in groups, and as a whole class.

Some intervals are necessary during the courses both for the physical posture and for reducing eye strain. There should not be any non-stop courses. Keep in mind to give students some space, and try to keep your talk time down.

To prevent students from getting bored, be sure to find an online course that is interactive, dynamic and fun. While this may have been difficult in the early days of e-learning, nowadays it is much easier: there are currently many providers offering all types of interactive training, with challenges and adventures, videos, storytelling, gamified solutions, simulators to ensure practice and game-based learning. To solve this problem, firstly, ensure that the courses are divided into several parts and consist of brief lessons that can be completed in a short amount of time. If students encounter major stumbling blocks to learning, they will probably never find the time to tackle them. Divide the courses.

Try to set a time limit. The fact that the training is online does not mean you cannot set deadlines. Establish a clear and simple calendar indicating when the student should have completed each part of the online course. Furthermore, based on the age groups, some sort of online activities are also necessary.

As Laurillard (2008: 27) argues that "We have to rethink the nature of the profession, seeing teachers as reflective practitioners, action researchers, and collaborative innovators – a learning profession in a learning system."

To foster personal interaction within the online world as much as possible. You can organize webinars, group work or forums where students can discuss and resolve their queries. It is essential that students have a teacher they can contact. You could also promote the use of social media during the training, thus providing an additional opportunity for social interaction and humanizing the learning process. First-time online participants will need plenty of support, encouragement and motivational input. Dropout rates for online courses tend to be quite high.

As Laurillard (2008: 34) "A more important principle of reform would be to trust teachers and lecturers, and give them the time and the tools to be learning professionals. And I have argued that the tools they need are the digital design environments that are capable of turning them into innovative, collaborative, reflective learners."

Encourage open discussion of ongoing problems and issues in your online group - be proactive. Set a few simple rules, establish terms/ times of your availability during the course. Try to create the right environment.

Work with your learners to explore how knowledge is constructed, assimilated and dealt with online. Help them to gain the skills they need to get the most out of the course.

Provide opportunities for participants to reflect - not only on what they have studied, but on the process of online study itself. Weekly journals are an ideal space for this kind of reflection. Allow participants to deal with this positively by planning for closure, and allowing them to continue working together if they wish.

Reflect and revise: Each course you run will flag up problems, issues and potential for improvement. Listen to your participant feedback and be open to incorporating the best of it into future versions of your courses.

As a result of the applications of students made to the Council of Higher Education Board, The Board in Turkey asked the universities to provide opportunities to their students to freeze their registration due to the lack of internet access, computer supply, etc. in their places. As Çakmakkaya and Akpınar (2018: 571) argue:

The aim of education is living of societies in prosperity, raising qualified individuals. Basic stakeholder in education activities are administrators, teachers and students. Well-trained administrators, teachers will contribute to education and training. Total-quality management in teaching activities are used in education. Leadership and orientation powers of qualified administrators and teachers in foreign language education will help reduce students' future anxiety.

#### Conclusion

Currently, about 1.5 billion students in the world cannot go to school. Unfortunately, there is no access to various technological tools and internet in the various parts of the world. There is not enough internet connection to use these tools or videoconference even if there is access. If there will be education, first of all, issues such as connection, access to technological devices must be solved. In other words, nowadays, online education is widely applied in the world, but does not fully replace the face-to-face education provided in the same environment apart from the crisis periods. The ideal is to combine the two systems.

Although the extent of the effects of digitalization will not be known yet, digital learning goes mainstream. The evolution of our technologies and our processes for online instruction is really just beginning. It is especially important that the teacher-student relationship is not broken in this process. During the process, teachers can keep their communication with their students alive by using different opportunities of technology and have the opportunity to follow the academic development of the students.

Serdyukov (2017: 28) underlies that "Whatever technologies we devise for education, however much technology we integrate into learning, the human element, particularly the learner and teacher, remains problematic. Thus, while taking advantage of effective educational technologies, we must situate those modern tools within a wider context of human education in order to preserve its humanistic, developmental purpose and, thus, make more effective use of them."

We should approach the promises of technological solutions with caution. Flexible and resilient educational systems require demand collaboration, care, preparation, expertise, resources and learning lessons from the past. None of us yet know what the 2020-21 academic year will look like, but we must plan now so that when we do, we have options properly developed and ready to implement

Governments need to help education institutions to develop a deep understanding of online pedagogy and make digital classroom affordable, decrease costs. Institutions should consider plans how to make lectures accessible on mobile phones and develop a revised curriculum document, and related learning materials, including text-books, which: include additional content-based and functional objectives, so that teachers give students a range of authentic and student-centered opportunities and reasons to communicate; encourage flexibility to show teachers how to meet differing abilities of students; Develop a comprehensive and sustainable system of in-service teacher training for English teachers.

More communication channels were important, ensuring that despite not physically seeing each other, concerns and experiences were shared. The feeling that "we are in this together", or "if I make a mistake in the online learning platform, I am not the only one", helped to support everyone in the journey. The quality of learning is heavily dependent on the level and quality of digital access and should be both inclusive and high-quality. Creativity and with flexibility are the key elements to success. Student and teacher motivation is important in distance education.

In this process, the support of teachers about the use of EBA, emphasizes that planning should be made for students who cannot access distance education due to their conditions, and who cannot monitor distance education tools effectively, and publications should be "pluralistic" and "inclusive" based on students' rights.

Despite all the opportunities shared by MEB (Ministry of Education) in Turkey, there may be students who cannot even access distance education due to the conditions they are in, and even if they have the opportunity to access, they cannot effectively monitor the distance education tools. It will be important to plan and share the activities to be carried out for groups at risk. It should be ensured that this group at risk should be monitored and supported by practices such as compensation training. Similarly, it is important to have options for students and teachers with special needs. Another issue that needs to be followed and precautions is the risk of school compliance and absenteeism in the classroom after the distance education process. The innovations, opportunities and risks that may arise from distance education will be considered as the second subject of our article series. It should also be prioritized to organize the application, which does not include students and teachers with special needs, considering the special needs.

We need to see this as a long-term process, not a short-term initiative. If something goes wrong, relax, stay calm, smile and ask the students if anyone has any ideas

Effective adaptation to rapidly shifting circumstances, preparedness, and a willingness to collaborate and offer care and support, and a cautious attitude towards untested educational technology are important steps for those challenges mentioned above. Thus, be willing to take risks and, in return, you will receive positive learning outcomes.

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# EFFECTIVE TEACHING QUALITIES OF INSTRUCTORS

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## **1. INTRODUCTION**

Teachers constitute one of the most important components of the education process. It is necessary for teachers taking part in the process of education to have content knowledge for the field and knowledge and experience related to their own profession. Also, through their professional knowledge, they must be able to use their skills related to the professional competency they have. In addition to the field knowledge which teachers have and these competencies for their professional knowledge, they are expected to follow both national and international developments, the latest educational surveys and also technological innovations with the general knowledge they should have. In all these areas, the role of pre-service education that teachers receive is determining in their becoming educators who meet the expectations and contribute to both their self development and the development of students in education process. The quality of the four-year undergraduate education that teachers receive in the faculties of education for the pre-service education affects the quality of the teacher (Celebi, 2014, p. 126; Yılmaz, 2014, p. 366)

With the understanding of the importance of the education quality in the pre-service education process of teachers, important arrangements have been made to the teacher training process in education faculties. One of these arrangements is the regulations for teacher training programs which were realized by the Council of Higher Education (CoHE) in 1998. With the mentioned arrangement, it was considered appropriate to rearrange the education in subject field, professional knowledge and categories of general knowledge that teachers receive in the process of pre-service education in a complementary way within the scope of education programs and also, it was decided that prospective teachers take the course of teaching practice in the first year of their education (CoHE, 1998). With these attempts in teacher training and education process, it has been aimed that pre-service teachers complete the pre-service education process by enabling the balance in theory and practice. These renewed programs were implemented for about eight years and in 2006, it was needed to perform a reorganization in teacher training process. Especially, in parallel with the curriculum changes put into practice by the Ministry of National Education within the academic year 2003-2004, it was stated that the education process of prospective teachers was also needed to be renewed. Moreover, with Turkey's involvement in the European Higher Education Area in 2003, it was understood that both teacher education and higher education system must be renewed to comply with the development and changes in Europe. Based on these reasons, it was stated that training teachers who are able to solve problems and teach learning is the main objective in line with the renewed teacher training curricula (CoHE, 2007). About twelve years after that recent arrangement, in order to train teachers eligible for the teacher profile that would keep up with the innovations made in the programs and/or curricula by the Ministry of National Education, making changes in teacher training programs became a current issue. In 2018, the curricula for teacher training were arranged so as to cover the professional teaching knowledge courses at 28-35%, courses for general knowledge at 15-20% and courses for field training at 45-50%, and it was agreed that a core program was created within the scope of teacher training curricula (CoHE, 2018).

With these regulations made especially for teacher training programs in the pre-service education process of teachers, prospective teachers are expected to develop the competencies that they need to have both theoretically and practically. Also, it is aimed that prospective teachers prepare themselves as teachers with the skills, behavior and experience to be gained during the four years spent in the pre-service education process. At this point, it is required to evaluate the competencies of the instructors serving as a role model for prospective teachers and to address the knowledge, skill and behavior levels of the instructors as teachers.

Arslantaş (2011), emphasizing that one of the major professional liabilities of instructors is the task of teaching, states that instructors also teach actually and therefore, the competencies we seek in teachers should also be found in instructors. In this sense, it is emphasized that the instructors who especially have full knowledge of the field, can effectively communicate with prospective teachers, succeed at classroom management, follow the instructional technologies closely and can use teaching methods in practice are effective in the process of pre-service education of teachers (Arslantaş, 2011; Karaca, 2008). In this respect, it is very important to find the basic characteristics and competencies that we actually expect for teachers in the instructors who educate and direct teachers. Instructors are also expected to pay attention to the personal characteristics standing out in teacher qualifications during the process of teacher training. The presence of instructors who address the needs and expectations of prospective teachers, can organize teacher training process according to the individual differences of prospective teachers, and can use the educational and instructional technology throughout teacher training will enhance the quality of both prospective teachers and teacher education and training (Celikten, Şanal & Yeni, 2005; Gökyer, 2012). On the other hand, with the change related to the responsibilities of teachers in the education process in line with the 21st century skills and with the understanding that teachers should take their parts in educational environments as creative and innovative educational leaders who criticize and question in this process, it is emphasized that the processes of pre-service education of teachers should also be renewed (Tutkun & Aksoyalp, 2010). In this respect, the competency of instructors is considered important in bringing the new understanding of teachers to the faculties of education and in training the prospective teachers as modern creative teachers who teach, convey, develop apart from traditional educator role, and take the lead.

With this study, it is aimed to determine the effective teaching qualities of instructors who take responsibility in the training of prospective teachers based on the data obtained from prospective teachers. For the objective of this study, the sub-problems of the research are given below.

1. Do the effective teaching qualities of instructors differ according to the faculty they teach at?

2. Do the effective teaching qualities of instructors at the faculty of education differ according to their departments?

3. Do the effective teaching qualities of instructors at the faculty of science and literature differ according to their departments?

# 2. METHOD

## 2.1. Research Model

This study was designed in survey model. Survey models are preferred for the researches which aim to describe individuals or situations that are the subject of the research as they are at present. Survey researches are carried out in two different ways as longitudinal and cross sectional design based on the time period within the research process takes place (Karasar, 2013, p. 77-81). In this study in which the effective teaching qualities of instructors are tried to be determined, data were collected simultaneously from the prospective teachers participating in the research and studying at different departments and faculties, and the data obtained instantly were analyzed together as if they were collected from the same group. Therefore, this research was carried out with the survey model based on the cross sectional design approach.

## 2.2. Research Sample

In order to determine the research sample, snowball sampling method was preferred by making use of non-probability sampling techniques. Non-probability sampling strategy is widely used especially in educational surveys since it enables the researcher to find the volunteer participants who have the qualities that the researcher desires. Snowball sampling is a research model through which the participants can identify other participants who want to be included in the research process and who are with the qualification suitable for the research within the non-probability samplings (Creswell, 2017, pp. 193-194). Accordingly, totally 314 senior prospective

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teachers studying at the faculty of education and attending the pedagogical formation program in the faculty of science and literature, constituted the sample of the research. Information related to the departments and faculties where the prospective teachers included in the research sample studied is presented in Table 1.

Faculty	Department	Prospective Teacher
Faculty of Education	Psychological Counseling	52
	and Guidance	
	Basic Education	55
	Social Studies Education	53
	Total	160
Faculty of Science and	Mathematics	52
Literature	Turkish Language and	52
	Literature	
	Philosophy	50
	Total	154
Т	otal	314

Table 1 Information about the prospective teachers included in the research

### 2.3. Data Collection Tool Used in the Research

In the collection of research data, the Scale for "Effective Teaching Specialties" developed by Şen and Erişen (2002) was used. The scale used in the research was prepared as 9 sub-groups and 95 items. Sub-dimensions included in the scale were stated as general knowledge, subject field knowledge, course planning and preparation, teaching-learning strategies, teaching aids and materials, communication, classroom management, assessment and evaluation, and personal characteristics. Considering the items related to these sub-dimensions in the scale, for instance, it is seen that the item "knowing basic principle and concepts related to the subject field" is included in the title of subject field knowledge. Similarly, one of the items related to the sub-dimension of teaching-learning strategies is stated as "creating opportunities to learn how to learn". The Cronbach Alpha reliability coefficient of the scale, prepared as 5-point, was determined as .9574 (Sen & Erisen, 2002).

In order to determine the suitability of the data for factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient and the values for Barlett's Test of Sphericity were calculated. KMO presents information about the sampling adequacy, and the Barlett's Test of Sphericity provides information on whether the variables are related, or not. If the KMO value is found higher than 0.60 and the Barlett's test is significant, this indicates the suitability of data for factor analysis (Büyüköztürk, 2002, pp. 72-94). Results (KMO=.946;  $\chi 2 = 15113.1$ ; p=0.00) show that data are suitable for factor

analysis. Within the scope of exploratory factor analysis, principal component analysis was carried out with the 95 items included in the original form of the scale. The graph Eigenvalue (Scree test) indicated that the scale had a one-factor structure and those factors explained the 35.860% of total variance. It is recommended that the items loading on more than one factor should be identified as overlapping and excluded from the scale (Büyüköztürk, Kılıc Cakmak, Akgün, Karadeniz & Demirel, 2011, pp. 76-88). As a result of the factor analysis, twenty items were excluded from the scale. These items are General Knowledge1, Subject Field Knowledge1, Planning5. Teaching-Learning Strategies8. Teaching-Learning Strategies15. Teaching-Learning Strategies18, Teaching-Learning Strategies19, Teaching-Learning Strategies22, Teaching Aids and Materials5, Classroom Management5, Classroom Management13, Assessment and Evaluation1, Assessment and Evaluation7, Assessment and Evaluation8, Assessment and Evaluation9, Assessment and Evaluation10, Assessment and Evaluation11, Assessment and Evaluation12, Assessment and Evaluation13, Personal Characteristics5.

Load values of the items in the scale are presented in Table 2.

Items	Factor 1
Comm.10	,747
Comm.7	,726
Class. Man.10	,724
Comm.9	,708
Comm.4	,703
Comm.8	,697
Per. Cha.6	,691
Class. Man.3	,690
Comm.11	,689
Teach. Learn.4	,688
Comm.12	,688
Per. Cha.7	,685
Teach.Learn.2	,678
Class. Man.11	,678
Comm.13	,678
Class. Man.8	,673
Per. Cha.8	,673
Class. Man.7	,656
Class. Man.12	,654
Per. Cha.2	,651
Comm.6	,650
Class. Man.6	,648
Teach.Learn.5	.645

Table 2 Scale item load values

Per. Cha.3	,642
Teach.Learn.1	,636
Teach.Learn.3	,633
Per. Cha.4	,629
Class. Man.15	,618
Class. Man. 4	,618
T. Aids and Mate.2	,616
Teach.Learn.21	,611
T. Aids and Mate.6	,610
Teach.Learn.13	,602
Per. Cha.1	,602
T. Aids and Mate.3	,598
Teach.Learn.7	,597
Comm.14	,594
Teach.Learn.6	,588
Class. Man.9	,586
Comm.2	,584
Teach.Learn.16	,582
Comm.3	,579
Teach.Learn.10	,576
Teach.Learn.23	,571
Teach.Learn.17	,571
T. Aids and Mate.7	,568
Planning1	,561
Planning 6	,559
Comm.1	,557
Teach.Learn.11	,551
Comm.5	,551
Subj. Field5	,549
Teach. Learn.14	,548
Ass. and Eva.5	,546
Subj. Field3	,545
Ass. and Eva.6	,544
Ass. and Eva.4	,536
Gen. Know.3	,536
T. Aids and Mate.1	,533
Class. Man.14	,523
Planning 2	,519
Teach.Learn.12	,516
Class. Man.1	,509
Subj. Field2	,506
Ass. and Eva.3	,500
Teach. Learn.20	,497
Class. Man.2	,493

Class. Man.16	,493
Gen. Know.2	,490
Subj. Field4	,490
Ass. and Eva.2	,487
Teach.Learn.9	,482
Planning 4	,480
Planning 3	,473
T. Aids and Mate.4	,470

The Cronbach's Alpha reliability result of the research was calculated as .974. The results of the reliability of the research and of item analysis are presented in Table 3 in detail.

		Quannes		
	Mean Value	Variance	Corrected	Cronbach's
	If Item	Value	Item - Total	Alpha Value
	Deleted	If Item	Correlation	If Item
		Deleted		Deleted
General	227 102	2671 292	172	074
Knowledge 2	257.195	20/1.382	.475	.974
General				o <b>-</b> (
Knowledge 3	237.617	2655.134	.526	.974
Subject Field 2	237.145	2667.692	.493	.974
Subject Field 3	237.293	2667.014	.531	.974
Subject Field 4	237.476	2663.205	.484	.974
Subject Field 5	237.322	2657.877	.535	.974
Planning 1	237.495	2651.980	.541	.974
Planning 2	237.248	2657.703	.504	.974
Planning 3	237.466	2662.830	.469	.974
Planning 4	237.582	2662.980	.468	.974
Planning 6	237.823	2646.469	.545	.974
Teach. Learn. 1	237.952	2641.123	.623	.974
Teach. Learn. 2	237.736	2638.446	.662	.974
Teach. Learn. 3	237.720	2641.654	.624	.974
Teach. Learn. 4	237.733	2640.654	.680	.974
Teach. Learn. 5	237.791	2637.385	.634	.974
Teach. Learn. 6	237.601	2649.034	.575	.974
Teach. Learn. 7	237.801	2642.992	.589	.974
Teach. Learn. 9	237.006	2664.077	.467	.974
Teach. Learn. 10	237.531	2651.631	.567	.974
Teach. Learn. 11	237.199	2657.283	.540	.974
Teach. Learn. 12	237.839	2655.329	.508	.974
Teach. Learn. 13	237.633	2641.743	.584	.974
Teach. Learn. 14	237.968	2644.031	.534	.974

Table 3 Reliability and Item Analysis Results of the Scale for Effective Teaching Qualities

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Teach. Learn. 16	237.650	2650.080	.565	.974
Teach. Learn. 17	237.836	2648.789	.557	.974
Teach. Learn. 20	237.846	2654.363	.493	.974
Teach. Learn. 21	237.672	2645.118	.603	.974
Teach. Learn. 23	238.113	2643.487	.568	.974
T. Aids and		2(40.050	<b>51 5</b>	0.7.4
Mat.1	237.476	2649.979	.517	.974
T. Aids and				
Mat 2	237.640	2644.696	.606	.974
T Aids and				
	237.707	2646.059	.588	.974
Mat.3				
I. Aids and	237.756	2660.727	.465	.974
Mat.4				
T. Aids and	237.010	2640 714	603	074
Mat.6	237.910	2040./14	.005	.9/4
T. Aids and		• < + + + • •	0	o <b>-</b> 4
Mat 7	237.547	2644.100	.550	.974
Comm.1	237.003	2662.197	.538	.974
Comm.2	237.212	2654.619	.567	.974
Comm.3	237.158	2657.494	.558	.974
Comm.4	237.543	2631.565	.685	.974
Comm.5	237.865	2647.975	.534	.974
Comm.6	237.453	2643.281	.627	.974
Comm.7	237.666	2632.907	.706	.974
Comm.8	237.367	2641.859	.678	.974
Comm.9	237.441	2633.544	.687	.974
Comm.10	237.502	2632.083	.725	.974
Comm.11	237.807	2634.266	.674	.974
Comm.12	237.717	2636.707	.670	.974
Comm.13	237.498	2632.922	.654	.974
Comm.14	237.765	2641.387	.580	.974
Class. Man.1	237.473	2655.902	.498	.974
Class. Man.2	237.035	2662.150	.481	.974
Class. Man.3	237.572	2639.091	.675	.974
Class. Man.4	237.434	2649.505	.603	.974
Class. Man.6	237.682	2639.908	.633	.974
Class. Man.7	237.424	2641.193	.634	.974
Class. Man.8	237.379	2638.352	.650	.974
Class. Man.9	237.177	2650.630	.563	.974
Class. Man.10	237.669	2632.551	.710	.974
Class. Man.11	237.476	2646.566	.663	.974
Class. Man.12	237.576	2640.335	.632	.974
Class. Man.14	237.367	2656.788	.514	.974

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Class. Man.15	237.186	2645.004	.596	.974
Class. Man.16	237.466	2657.643	.481	.974
Ass. and Eva.2	237.752	2657.613	.474	.974
Ass. and Eva.3	237.691	2657.027	.484	.974
Ass. and Eva.4	238.145	2654.950	.529	.974
Ass. and Eva.5	238.119	2652.770	.535	.974
Ass. and Eva.6	237.977	2655.319	.530	.974
Ass. and Eva.12	238.219	2689.262	.167	.974
Per. Cha.1	237.367	2652.368	.583	.974
Per. Cha.2	237.302	2644.508	.628	.974
Per. Cha.3	237.508	2644.160	.625	.974
Per. Cha.4	237.244	2640.005	.608	.974
Per. Cha.6	237.225	2645.956	.675	.974
Per. Cha.7	237.341	2641.342	.666	.974
Per. Cha.8	237.135	2646.014	.651	.974

### 2.4. Data Collection

The data of the research were collected directly from the participants by the researcher. In the process of data collection, other participants were reached with the guidance of participants and the scales filled in by the prospective teachers who wanted to participate in the research voluntarily were included in the research. During data collection, the scale was applied on the days when and in the classrooms where the prospective teachers studying at the faculty of education took their courses. While collecting data from the prospective teachers studying at the faculty of science and literature, the scale was applied on the days and in the classrooms which were arranged for their courses within the scope of pedagogical formation program. Answering the scale lasted for approximately thirty minutes. While the prospective teachers were answering the scale, the questions related to the research were answered by them, and also, it was stated that the information about the participants would be kept confidential. The answered scales were classified by the departments and faculties and saved by the researcher.

#### 2.5. Data Analysis

The data of the research were analyzed by using SPSS-23 statistical package for data analysis. T-test and one-way ANOVA were used in the analysis of the findings related to the effective teaching qualities of instructors. Findings obtained as a result of data analysis were presented in tables in line with the sub-problems of the research. While analyzing the data, the confidence interval was accepted as 95%.

# **3. FINDINGS**

Findings obtained in the research were presented based on the sub-problems of the research.

# **3.1. Effective Teaching Qualities of Instructors According to the Faculty They Teach at**

Based on the findings obtained from the prospective teachers, the result of the independent samples t-test which was carried out in order to determine whether the effective teaching qualities of instructors differed significantly according to the faculty where the instructors teach at, or not, is presented in Table 4.

Table 4 Effective Teachir	g Qualities of Instructors A	According to their Faculty
---------------------------	------------------------------	----------------------------

Faculty	N	Ā	S	sd	t	р
Faculty of Education	159	229.80	36.01	309	2.96	.001
Faculty of						
Science and Literature	152	247.01	63.33			

Based on the t-test result presented in Table 4, it was determined that the effective teaching qualities of instructors differed significantly according to the faculty where the instructor taught at ( $t_{309}$ =2.96. p<.01). It was concluded that the instructors teaching at the faculty of science and literature ( $\bar{X}$ =247.01) had more effective teaching qualities than the instructors at the faculty of education ( $\bar{X}$ =229.80).

# **3.2.** Effective Teaching Qualities of Instructors at the Faculty of Education According to their Departments

Considering the findings obtained from the prospective teachers, the result of one-way ANOVA that was carried out in order to determine whether the effective teaching qualities of instructors at the faculty of education differed significantly according to their departments, or not, is presented in Table 5.

Table 5 Effective Teaching Qualities of the Instructors at the Faculty of Education According to their Departments

Source of Variance	Sum of Squares	Sd	Mean of Squares	F	р	Significant Difference
Inter- groups	21139.574	2	10569.787	8.972	.000	PCG-BE, PCG-SSE
Intra- groups	183773.382	156	1178.035			
Total	204912.956	158				

Based on the one-way ANOVA results presented in Table 5, it was determined that the effective teaching qualities of the instructors at the faculty of education differed significantly according to their departments ( $F_{2,156}$ =8.97, p<.01). According to the results of Scheffe test carried out to reveal among which departments there was the difference in the effective teaching qualities of the instructors, it was found that the instructors at Basic Education (BE) department ( $\bar{X}$ =237.527) and the instructors at Social Studies Education (SSE) department ( $\bar{X}$ =238.173) had the effective teaching qualities more than the instructors at Psychological Counseling and Guidance (PCG) department ( $\bar{X}$ =213.269).

# **3.3. Effective Teaching Qualities of Instructors at the Faculty of Science and Literature According to their Departments**

Considering the findings obtained from the prospective teachers, the result of one-way ANOVA that was carried out in order to determine whether the effective teaching qualities of instructors at the faculty of science and literature differed significantly according to their departments, or not, is presented in Table 6.

 Table 6 Effective Teaching Qualities of the Instructors at the Faculty of Science

 and Literature According to their Departments

Source of Variance	Sum of Squares	Sd	Mean of Squares	F	р	Significant Difference
Inter- groups	145087.654	2	72543.827	23.465	.000	TLL-MAT, TLL-PHIL
Intra- groups	460641.287	149	3091.552			
Total	605728.941	151				

Based on the one-way ANOVA results presented in Table 6, it was determined that the effective teaching qualities of the instructors at the faculty of science and literature differed significantly according to their departments ( $F_{2,149}$ =23.465, p<.01). According to the results of Scheffe test carried out to reveal among which departments there was the difference in the effective teaching qualities of the instructors, it was found that the instructors at Turkish Language and Literature (TLL) department ( $\bar{X}$ =285.519) and the instructors at Mathematics (MAT) department ( $\bar{X}$ =243.057) had the effective teaching qualities more than the instructors at Philosophy (PHIL) department ( $\bar{X}$ =209.604).

# 4. CONCLUSION AND DISCUSSION

In the process of education which prospective teachers receive during pre-service period, the effect of instructors is highly important. Especially, the knowledge and behaviors of instructors are determinant for prospec-

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tive teachers to gain the competencies at the levels of profession, field knowledge and general knowledge. Therefore, in this study, it has been aimed to determine the effective teaching qualities of instructors based on the opinions of prospective teachers. For this purpose, the senior prospective teachers studying at different departments in the faculty of education and the senior prospective teachers studying at different departments in the faculty of science and literature and attending the pedagogical formation program were asked for their opinion. Findings obtained from the analysis of data gathered through the Scale for "Effective Teaching Specialties" developed by Şen and Erişen (2002) were presented within the framework of the sub-problems of the research.

Based on the first sub-problem of the research, it was investigated whether the effective teaching qualities of the instructors differed significantly according to the faculty where they taught. As a result of the independent samples t-test, it was determined that the instructors at the faculty of science and literature had the effective teaching qualities more than the instructors at the faculty of education. That situation was interpreted as the high level of awareness which the prospective teachers studying at the faculty of education had about teacher competencies and effective teacher behaviors; therefore, it was considered that the expectations and criteria of those prospective teachers were greater while evaluating the instructors. Also, it was thought that the prospective teachers studying at the faculty of education were more aware of how instructors should behave as effective teachers and what they should do, when compared to the prospective teachers studying at the faculty of science and literature. Accordingly, it caused the prospective teachers to examine more meticulously and in more detail while evaluating the instructors. On the other hand, since the prospective teachers studying at the faculty of science and literature receive education for the pedagogical formation only for one semester and their experiences of effective teaching qualities are more limited than those of the prospective teachers studying at the faculty of education, it can be said that the prospective teachers studying at the faculty of science and literature interpret the effective teaching qualities in general and superficially while evaluating the instructors. In a similar research conducted by Arslantas (2011) on this subject, it was found that the students of the education and science and literature faculty did not see the instructors at a sufficient level in terms of the skills of using instructional strategies, methods and techniques. In addition, findings obtained in the research conducted by Murat, Aslantas and Özgan (2006) also show parallelism. In this research, it was found that the instructors were not qualified with enough knowledge and skills in the field of classroom management, and in the same research, it was also emphasized that the education which the instructors received on

the initial teacher training should be considered important (Murat, Aslantaş & Özgan, 2006). However, in the research carried out by Durmuşçelebi, Çolak and Meliköylü (2016), it was concluded that the instructors often demonstrated effective teacher behaviors. In the same research, it was stated that the prospective teachers were satisfied with the instructors giving lectures to them (Durmuşçelebi, Çolak & Meliköylü, 2016). Regarding these researches, it was seen that the possession and demonstration of the effective teaching qualities by the instructors varied by the sample group.

Based on the second sub-problem of the research, it was investigated whether the effective teaching qualities of the instructors teaching at the faculty of education differed significantly according to their departments. As a result of the one-way ANOVA test, it was determined that the instructors at Basic Education and Social Studies Education departments had the effective teaching qualities more than the instructors at Psychological Counseling and Guidance department. Considering that the prospective teachers evaluate all the instructors giving the lectures during their undergraduate education, it is thought that this result is not due to the instructors who are the educational sciences specialist teaching the common courses at departments, but it results from the instructors who are the field education specialist teaching the main field courses. Based on this, it was understood that the instructors as the field education specialists in Psychological Counseling and Guidance had less effective teaching qualities than the other instructors. When the literature was reviewed, no such research couldn't be found among the divisions or departments in the faculty of education. For this reason, it has been observed that the effective teaching qualities of the field educators are needed to be evaluated while the prospective teachers are educated and trained for different fields in the faculty of education. With the new researches to be carried out on this subject, new practices and studies which increase the levels of effective teaching qualities of the instructors who are the field education specialists and improve their skills and behaviors at the level of teacher competencies can be developed.

Based on the third sub-problem of the research, it was investigated whether the effective teaching qualities of the instructors teaching at the faculty of science and literature differed significantly according to their departments. As a result of the one-way ANOVA test, it was determined that the instructors at Turkish Language and Literature and Mathematics departments had the effective teaching qualities more than the instructors at Philosophy department. This result is quite different from the result obtained based on the departments of the instructors in the education faculty, because all of the instructors giving the lectures in the science and literature faculty are the instructors who have received the field specialist training in their departments. In this case, it is thought that the fact that the instructors at Turkish Language and Literature and Mathematics departments have the effective teaching qualities more is related to the undergraduate and postgraduate education they have received or to the professional experience they have had. Similarly, in the research carried out by Özbek and Yeşil (2009), the prospective teachers evaluated the in-class teaching competencies of the instructors. In the same research, it was concluded that there was a significant difference between the in-class teaching competencies of the instructors at the Turkish Language and Literature department and History and Geography department (Özbek & Yeşil, 2009).

When the results obtained from this research and the similar research results are considered together, it is seen that all the instructors taking part in the education and training process of prospective teachers should have the effective teaching qualities, regardless of departments and faculties. Especially the instructors who perform at the faculty of education have greater responsibility in this regard. For this reason, it is necessary to determine the effective teaching qualities of all the instructors at the faculty of education which trains teachers in different fields or divisions and especially of the instructors carrying out the courses of field education and training. Based on the results obtained, the teaching qualities for which there is a need to be developed in the instructors should be specified and the relevant studies should be carried out on department basis or throughout the faculty. Yavuz, Özkaral and Yıldız (2015) examined the reports related to teacher competencies, teacher training and trainers in their research and reached considerable findings. In the same study, it was emphasized that the role of teacher trainers was very important in training teachers and the qualifications of teacher trainers were highly effective in enhancing the quality of teacher training (Yavuz, Özkaral & Yıldız, 2015). On the other hand, in the research done by Erginer and Dursun (2005), it was stated that nearly half of the instructors possessed effective teaching skills and the studies for the improvement of those skills were needed. Considering these results obtained from the literature, it is believed that the instructors who are the teachers of the prospective teachers in the process of teacher training should improve themselves in terms of their teaching qualities, and thus, the pre-service education to be received by prospective teachers will be more effective and successful.

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# DETERMINATION OF STUDENTS' MISTAKE PROFILES WITH ERROR Q MATRIX METHOD IN COGNITIVE DIAGNOSTIC MODELS

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# INTRODUCTION

### **Cognitive Diagnostic Models**

In the literature, Cognitive Diagnostic Models (CDMs) are also known as cognitive psychometric models (Rupp and Mislevy, 2007), cognitive diagnostic models (Tatsuoka, 1995), restricted latent class models (Haertel, 1989), multiple classification models or item response theory models (Rupp and Mislevy, 2007). These denominations lay emphasis on the statistical characteristics of models and refer to theoretical infrastructure in some models while representing the unique purposes of others.

The purpose of CDMs is to classify students according to latent categories that are based on the combination of dichotomic competencies. These competencies can be expressed as quality, task, eligibility, cognitive process or skills (Tatsuoka, 1995). A test developed in accordance with CDMs measures each individual with the purpose of revealing what skills that individual has or has not from among the included, instead of offering a total continuous test score. Therefore, the tests developed with CDMs have the capacity to determine the educational requirements of each student(Cheng and Chang, 2007). CDMs focus on the cognitive processes that a student uses during answering process and reveals a multi-dimensional profile for that student by primarily analysing the underlying structure of a skill employed to solve a tested quality (Başokçu, 2014; Yan, Almond, and Mislevy, 2004).

CDMs determine a student's performance for each capability and the availability of such capability in that student. The probabilities obtained are then transformed into a skill profile for a student. Before the analysis, the relationships between latent variables and items should be identified in order to obtain these probabilities. This relationship is indicated with an item-quality matrix which is also known as Q matrix.

## Q Matrix

Q matrix is a pattern on which competencies and items are indicated in columns and rows, respectively. These competencies can be characteristics, procedures, strategies, skills, qualities and other information components defined by experts. Q matrix uses "1" and "0" as codes to show whether a certain competency is available in a relevant item. These codes were first defined by Fischer (1973) as "weighting". According to this, it was suggested that when a k quality is present in a j item, "1" is inscribed as a code while "0" is written on the contrary. Table 1 shows an example of Q matrix prepared for 3 qualities and 5 items.

	1	<i>v</i> ≈	
Items	α1	α2	α3
1	1	0	0
2	1	1	0
3	1	1	1
4	0	1	1
5	0	0	1

Table 1. Example of Q Matrix

The Q matrix above indicates that  $\alpha_1$  suffices to provide a correct answer to item 1 while both  $\alpha_1$  and  $\alpha_2$  are necessary to give a correct answer to item 2. As a result of the analysis according to the above example of Q Matrix, answerers are categorized under 2<sup>3</sup> latent class due to three qualities. These latent classes are (000), (100), (010), (001), (110), (101), (011) and (111). Latent classes show the qualities that students possess. Among the latent classes given above, students classified under (000) do not have any quality. Similarly, only the students with  $\alpha_3$  can be associated with (001) latent class while the students who have  $\alpha_1$  and  $\alpha_3$  but lack  $\alpha_2$  can be included in the (101) class.

### **The DINA Model**

Developed by Haertel (1989), the DINA Model is an extension of Item Response Theory (IRT). While IRT assumes that students have capabilities that show a continuous distribution, the DINA Model categorizes them under a couple of varying predetermined latent classes. Since the DINA Model aims to reveal the latent quality of a student, it grounds the relationship between latent quality and an observed capability on probability and provides two parameters for each item. These are s (slip) and g (guess) parameters.

Equation 1. Item Parameters of the DINA Model

$$s_j = P[Y_{ij} = 0 | \eta_{ij} = 1]$$
 ve  $g_j = P[Y_{ij} = 1 | \eta_{ij} = 0]$ 

Y: Individual response

 $\eta$ : Quality, latent answer determined by α

According to the above formulation, s represents the probability of wrong answer to the item by the individual with latent quality (false positive probability) and g refers to the probability of correct answer to the item by the individual without latent quality (correct positive probability). The s parameter should be low in order to increase the probability of correct answer by the individuals who have the required qualities (de la Torre, 2009). The gj parameter is also defined as guess parameter in the literature. Maris (1999) defines this also as "successful use of the ability of mental guess". The g parameter has a different structure compared to the c parameter in IRT. The g parameter anticipates that a student without the quality necessary to give a correct answer may actually provide a correct answer. Similarly, it also presumes that a student can give a correct answer using qualities other than those necessary to furnish a correct answer to an item. This shows that the qualities which are not defined in Q matrix are sufficient to furnish a correct answer to an item. That is, the g parameter which may be close to 1 for an item can be interpreted in two ways: individuals without the quality have provided a correct answer and the qualities necessary for a correct answer are determined insufficiently. In the DINA Model, the item-response function is as follows:

### **Equation 2. Item-Response Function of the DINA Model**

$$P(\alpha_{ij}^*) = \begin{cases} g_j \\ 1 - s_j \end{cases}$$

If  $\alpha_{ij}^* < \mathbf{1}_{K_j^*}$ , vice versa applies.

The  $K_j^*$  length in the function represents the probability that students may provide a correct answer even though they do not have at least one of the qualities necessary for  $g_{j}$ , *j* item, where  ${}^{1}K_{j}^*$  is a vector of an individual. On the other hand,  $1 - s_{j}$  refers to the probability that students may provide a wrong answer to an item even though they have all the necessary qualities and do not make a slipping error (de la Torre, Hong and Deng, 2010).

The DINA Model bi-dimensionally classifies students for each quality as the null and full classes. The null class is a class consisting of individuals without any quality while the full class includes individuals with the necessary qualities. In a sense, the DINA Model is not based on a continuous but a categorically variable quality parameter. As a result, it offers  $2^k$  latent classes. Here, the *k* symbol points out to the number of qualities/competencies in Q matrix. In analyses, it is estimated for each quality whether a student has it, and alpha parameters are established.

The most significant difference of the DINA Model compared to other Cognitive Diagnostic Models is that, in tests that require multiple skills, it is a "strict" model which includes a student without any quality necessary for an item in a null class. In other words, the probability that a student with all the qualities may provide a correct answer to an item is 1 while the same for a student without any quality is 0.

In the DINA Model, the s and g parameters come into question on the item level as each item divides sample in two classes. In this sense, the probability of providing a correct answer is equal for students of the same class which is 0 or 1. However, the performances of students are not an exact indicator of the quality measured with a test. Therefore, a model based on probability only allows seeing the probability of s and g. When determining the model, it should be settled whether the s and g parameters occur at the sub-task or item level because slip is explained as the failure to provide correct answer to sub-tasks despite having a required quality while guess is interpreted as successful completion of or giving the correct answer to sub-tasks despite lacking certain qualities (Başokçu, 2014).

#### Mathematical Error Sources

The purpose of education is to ensure that all students make the best of learning processes. However, it is taken for granted that a majority of students experience difficulties or failures in learning mathematics (Tall and Razali, 1993). In this sense, the difficulties in learning mathematics should be eliminated immediately in order to achieve the purpose of education (Duval, 2006). This is because inter-conceptual relations are very strong and multidimensional in mathematics, and it is almost unlikely for a student not to experience difficulties during further stages if he or she has encountered difficulty of learning in a subject (Niss, 1999).

Compared to correct answers, errors are generally more instructive in the improvement of learning. It ensures more information to students with feedback when evaluating and developing the level of learning of a mathematical concept by a student. Indeed, even students who are successful in learning new subjects which may look simple can experience difficulties if their errors are not corrected (Hodgen and Askew, 2010). However, errors should not be primarily regarded in developmental or conceptual terms. Like adults, children may also make errors when they misread or misremember and are subject to "excessive cognitive load" or "skip directly over to result" (Sweller, 1994, 2004; Sweller, van Merrienboer and Paas, 1998). Some studies suggest that lack of motivation (aggravated by low anxiety levels) may affect the test performance of children adversely and that this is because they make mistakes when they have very low levels of motivation (Petridou and Williams, 2007).

Skemp (1971) suggests two error levels in mathematical education as superficial (first) and deep (second) levels. The first level is related to accessible and observable superficial behaviour and, in general, includes procedures and responses to tasks etc. According to (Williams, Ryan, Hadjidemetriou, Misailidou and Afantiti-Lamprianou'ya (2014), this shows that errors arise from reasons/misinterpretations. On the other hand, the second level, which is the deep level, is about the method of forming a conceptual ground or reason and its definition and interpretation.

The errors which can be employed to improve the quality of education may result from various reasons. Some of these are conceptual errors, misinterpretation of symbols and texts, complexity or difficulty of a mathematical subject, inexperience in a given subject or concept, lack of comprehension and information, failure to check a given answer and lack of attention. (Burns, 2007; Cockburn and Kent, 1999; Drews, Dudgeon, Lawton and Surtees, 2014; Ryan and Williams, 2007). The outstanding possibilities to take into consideration when a student makes a mathematical error are as follows (Cockburn and Kent, 1999).

1. Does the student know what operation to apply?

2. Does the student know how to apply an operation?

3. Does the student comprehend the process of an operation in terms of language and mathematics?

The above possibilities can be called as "Operation Difficulty", "Transformation Difficulty" and "Difficulty of Comprehension of a Mathematical Condition", respectively. These difficulties can be revealed with error analyses.

Here, error analysis is important in two aspects. First, it can ensure the development of various methods to determine learning difficulties according to the requirements of academic applications and to enhance the awareness, performance and comprehension of students. Second, error analysis is considered as a starting point for the process since it is regarded as a significant research strategy to elucidate certain fundamental problems in learning mathematics. (Radatz, 1979).

# Difficulty of Comprehension of a Mathematical Condition

The first step of solving a problem is to read and comprehend that problem. In this context, difficulty of reading and comprehension may arise due to various reasons. We can assume insufficient vocabulary, unsatisfactory reading habits, inability to focus on details, inability to distinguish given facts from unknown facts, and inability to understand results among these reasons (Aksu, 1984).

Mathematical concepts are easily miscomprehended and mislearned for they are abstract concepts. Similarly, each concept is a step to further concept(s) for mathematics is a cumulative discipline. Therefore, difficulty or error in learning a concept may lead to further and new difficulties and conceptual errors in related future concepts. (Duatepe Paksu, 2010).

Transition from informal and contextual language to formal language in mathematics is a procedure that requires attention. It is a pedagogical process to determine when to adopt informal language and when to proceed with formal language in mathematics. In general, daily contexts provide a significant source for teaching mathematics. For example, cutting a cake into equal parts is a widespread application in teaching fractions because teachers know that children can demonstrate their knowledge of cutting a cake in class. Indeed, children know how to divide a cake in order to share it among two, four or more people. However, when they encounter questions like 'how many halves make 6 full cakes' or 'how 6 cakes can be divided among 12 people', children cannot physically divide 6 full cakes by "half" in order to get 12. In this regard, partition of cakes offer a useful starting point for fractions but cannot give the context to the fullest extent (Ryan and Williams, 2007).

There is almost no model, context or representation to suggest a satisfactory or sufficient solution which can ensure progress in any branch of mathematics. In general, more than one model, context or representation is required, and teachers should resiliently switch and establish a connection among these. For example, money is beneficial in teaching fractions only if all the numbers have two decimals; measures of length provide a good context for flexibility between decimals and units; shading certain squares on a chequered area is useful to show the relative greatness of the various digits of a fraction; or number line is helpful to teach the order of fractions. Many researchers examined the methods of use of models by children in order to improve mathematical education for children and revealed the significant role of models in learning. In this sense, especially number line was analysed thoroughly, and its importance was proved experimentally and theoretically (Anghileri, 2001; Beishuizen, 1999). Lakoff and Núñez (2000) studied number line metaphorically and in terms of embedded cognition, and asserted that number line helps students to physically and spatially position themselves in mathematics. Generally, these models encourage students to communicate and express opinions using gestures and mimics as well as words (Ryan and Williams, 2007).

According to Wartosfsky and Black, the use of such representations (including metaphors, contexts and models) add sense to mathematics by establishing a connection between mathematics and the facts that are already known intuitively (quoted by Ryan and Williams, 2007). If we didn't have chequered area, function machine, number line, cake slices, money/length context in decimals or Cartesian system, mathematics would be very formal which would make it difficult for people to learn or use mathematics. Nevertheless, such concretization of mathematics also brings along certain limitations. In fact, a context or model becomes the mathematics itself when it is considered as a complete and error-free equivalent of mathematics. Since this is of no question, errors mostly show that there is a distinction between the use of models, contexts or metaphors by a child and targeted mathematics. Therefore, these put forth a discipline in learning which should be studied by pedagogics (Ryan and Williams, 2007).

As regards to the comprehension of concepts in learning mathematics, Brissenden (1998) emphasizes that students should know how rules work and be able to explain them to another person instead of applying them without knowing what they are for (quoted by Lovell, 2002). Comprehension of concepts by a student is the ability to think and reason when conceptual definitions, representations and relations are in question. Complete achievement of conceptual comprehension provides advantages in introducing restrictions to the methods employed by students when dealing with mathematical problems, ensuring the discovery of operational errors if any, and showing the steps of problem solving (quoted by Yeşildere, 2006). It can be claimed that conceptual comprehension is actually attained when students define concepts and provide examples; use and associate charts, models and concepts with their thoughts; apply facts and definitions consciously; make out and compare interrelated concepts and principles; acknowledge, apply and interpret the symbols, marks and terms used for the expression of concepts (NAEP, 2002).

## **Transformation Difficulty**

Transformation difficulty, the second type of difficulty which may be experienced by students while solving problems, can lead to errors in the transformation of a problem from verbal to symbolic form. This difficulty which is also referred to as structure difficulty can arise out of the failure to distinguish the significant and irrelevant data in a problem, recognize fundamental relations and procedures, apply operations systematically and have good study habits (Aksu, 1984).

Although they may learn individual concepts, these students are not inclined to learn concepts as defined in mathematics. It seems that people generally follow a "prototypical" concept development method (Lakoff and Núñez, 2000). By definition, prototype culturally refers to "a typical example" of a concept. For example; for adults, prototypically, a rectangle is an oblong figure with longer laterals thrice wider than short laterals. In prototypical terms, almost no one thinks of square as an example of rectangle. Therefore, children accept a figure as a square or rectangle only if its base lies horizontally and "parallel" to a surface. In further stages, they reject that square is also a rectangle or all rectangles are actually parallelograms. As a result, we see familiar errors in mathematics because people develop concepts informally and intuitively through "non-mathematical"

and prototypical ways. The mathematical definition of a concept is generally established with a series of examples and descriptive relations but never resorts to prototypical thinking. Having recognized that prototypical thinking is natural and intuitive, it can be seen that there are also many other prototypical errors (Ryan and Williams, 2007).

When transformation difficulty is observed, questions can be addressed to students about the data given in a problem or guidance can be offered as regards to the discernment of fundamental relations, relevant formulas, hidden details and important reasons and the formation and classification of relevant charts and figures. Teachers should ensure that students have the opportunity to deal with various exercises such as creating verbal problems by using data and transforming verbal expressions into mathematical symbols or vice versa (Aksu, 1984).

### **Operation Difficulty**

Operation difficulty is the last type of difficulty discussed in this paper. Students' failure to have a solid grasp of fundamental principles, rules, formulas and operational paths and their inattention can lead to errors due to operation difficulty. In order to overcome this, they can repeat fundamental principles and rules and do exercises with formulas and methods (Aksu, 1984).

As students acquire the knowledge of operations and rules, they also learn why a certain operation is applied as well as how to apply it. Operation difficulty, which may come into question when this information is not acquired, results in failure to establish a relation and model between operations and abstract concepts and to decide when to use operations. A student who learns operations as a cluster of rules to memorize and cannot adapt to mathematical concepts may have had a difficulty in learning relevant concepts (Baykul, 2005).

In addition to applying appropriate rules, knowledge of operations is also useful when students read, create and use charts, apply quantitative procedures (such as guessing and rounding) and reason whether correct operations are employed according to a given expression. It can be asserted that students are knowledgeable with operations when they correctly pick and apply operations, explain the operations they use and make changes in operations according to conditions in order to solve a problem (NAEP, 2002).

Rather than being occasional, student mistakes are generally systematic errors and stem from rules (Ben-Zeev, 1996). Apart from the creativity of students, these errors may also result from an education based on rote learning. Students summarize or generalize procedures by following the steps of exemplary solutions. However, they may overgeneralize or oversummarize rules and procedures when their knowledge is insufficient or acquired by memorization (Ben-Zeev, 1996; VanLehn, 1986). For example; if they learned only the subtraction of a smaller number from a greater one, students may overgeneralize the rule of subtracting smaller number from the greater in single-digit operations by referring to multi-digit numbers. Similarly, if students learned how to borrow from the next digit in two-digit numbers, they may overgeneralize this rule in subtractions with multi-digit numbers (VanLehn, 1986).

One way to alleviate these difficulties is to help students establish connections between conceptual and operational information. Formation of conceptual knowledge requires the definition of concepts, description of the similarities and differences between concepts according to these properties and builds relations among them. On the other hand, operational knowledge necessitates the configuration of abilities, strategies and algorithms that need to be terminated (Byrnes and Wasik, 1991). For example; students who cannot align decimals while dealing with additions or subtractions of decimal fractions most probably do so for they cannot establish a connection between the positional values of decimals and decimal arrangement (Hiebert and Lefevre, 1986). More complex connections like the addition of similar values require the generalization and reflection of bits of information such as decimal aligning for the addition of decimal fractions or looking for common denominators. Although all such connections may be familiar for adults, students can experience difficulty to form these (Yetkin, 2003).

Perhaps, the most important inference that can be asserted here is that "all generalizations are or will be overgeneralizations" since given facts are incorrectly expanded (or limited). In consequence, it appears that errors due to overgeneralization are unique to mathematics and mostly refer to generalization issues (Ryan and Williams, 2007).

After solving problems and coming up with answers, students generally fail or neglect to check results. At this stage, students encounter difficulties for they are not familiar with checking methods, cannot make correct guesses, and cannot discover and interpret the limits defined by data. Students can acquire checking habits if they are taught the difference between the necessary and adequate conditions in problems, and guessing methods.

There are certain common threads of the errors which occur due to modelling, prototyping, overgeneralization and process-target relationship. First of all, these errors define the condition of a student (to an extent). Secondly, these are the natural consequences of building mathematics based on reasoning which includes generalizations and concept formations. And

thirdly, these errors represent a learning opportunity or area and, therefore, promise a potential for development (Ryan and Williams, 2007).

Students generally have a notion that a target will be pointed out and then handled in education (for example, perceptions and errors). Error, on the other hand, is a superficial situation or a behavioural response to a given task. It is clear that correction of errors alone cannot provide a sufficient education to children. As long as students do not learn why a correct answer is correct, such corrections produce harm rather than benefit. In the end, children accept mathematics as a senseless and mysterious activity (Ryan and Williams, 2007).

### **Purpose and Significance**

Using Cognitive Diagnostic Models, this study aims to develop a model to determine not only the cognitive profiles of the students who take this test but also their error profiles, simultaneously. Following the improvement of the methods of assessment and statistics based on assessment results, the approaches that endeavour to get multi-dimensional information from a test and give wider and more detailed feedback to students gained momentum. In this sense, CDM analysis is designed to offer a multi-dimensional and quite rich information. In this study, we attempted to give feedback as regards to what information and cognitive skills are used for the items answered correctly. Furthermore, we also aimed to reveal what educational deficiency and error made students answer a question incorrectly.

### METHOD

#### **Population and Sample**

The population of this study consists of 448 state schools from 30 districts under Izmir Provincial Directorate of National Education. These schools provide education to 45069 6<sup>th</sup> grade students from 1822 classes. Having determined confidence level as 99% and *t*=2, the sample size for a population of 45069 was found out to be *n*=3809 (Oulte, 2011; Thompson, 2012).

Parameter estimation improvement diminishes seriously when the sample size is low and the number of items in the test is smaller than the number of latent classes to arise (Kunina-Habenicht, Rupp and Wilhelm, 2012). Rupp (2007) states that student classification accuracy increases with sample size. Similarly, there are studies to suggest that, in CDMs, sample size has a significant role on fit indexes (Lei and Li, 2016). A sizable sample can be come in useful as regards to its effect on model harmony and classification accuracy (Ravand and Robitzsch, 2018). In this sense, the sample of this study has the sufficient size.

In the next step, 4592 students from 20 schools and 148 classes were selected as the sample of this study using random cluster sampling by stratification. The increase in the sample is due to the fact that no discrimination was possible among the 6<sup>th</sup> grade classes. As a result, both the sample had increased capacity to represent the population, and certain classes were not excluded or school-wide equality was not violated.

### **Data Collection Tools**

As this study has been carried out as part of TUBITAK 115K531 project, it has been performed as part of the test development processes under this project. In addition to the acquisition and mathematical competencies developed for the tests availed in this study, the Q matrices showing mathematical errors were also designed by experts.

### **Determination of Mathematical Error Matrices**

In this study, the widely observed errors in mathematics were identified to be inability to comprehend a problem, difficulty of comprehension of a mathematical condition, insufficient conceptual knowledge, insufficient operational knowledge, lack of attention, inability to transform into mathematical language and inability to use operational knowledge.

In consequence of the analysis on pilot schemes, the observational tests applied under the project determined 3 basic mathematical errors which could be used as part of feedback system and, by this means, Q matrices were formed. These incapabilities and project analysis codes are given in Table 2 below.

Code	Competency
E1	Difficulty of Comprehension of a
	Mathematical Condition
E2	Transformation Difficulty
E3	Operation Difficulty

Table 2. Mathematical Errors and Codes

Difficulty of Comprehension of a Mathematical Condition (E1): The frequency of this error by a student shows his or her level as regards to lack of information, conceptual error, inability to see details and inability to distinguish given data from unknown facts (Basokcu, 2019).

Transformation Difficulty (E2): The frequency of this error by a student shows his or her level as regards to inability to transform into mathematical language, inability to make out fundamental relations and lack of operational knowledge (Basokcu, 2019).

Operation Difficulty (E3): The frequency of this error by a student shows his or her level as regards to inability to pick the most appropriate solution and incapacity in operations that require attention (Basokcu, 2019).

During the project, 7 tests were used in total wherein the foregoing mathematical errors were included. Among these tests, this study only uses the one coded as Observation-4. The following tables and the data reported henceforward have been achieved through this test only. Table 3 below gives the error Q matrix of the test.

Item	E1	E2	E3
5017_A	0	1	0
5017_B	0	1	1
5036_A	1	1	0
5036_B	1	1	0
5036_C	1	0	0
5058_A	1	0	0
5058_B	1	1	0
5059	0	0	1
5057	1	0	0

*Table 3. Mathematical Error Matrix* 

Each cell in the Q matrix represents the mathematical errors that are exhibited by the student where a question is answered incorrectly. Other Q matrices prepared for Observation-4 test are given in Table 4.

Item	M1	M2	M3	M4	K1	K2	K3	K4	K5
5017_A	1	0	0	1	1	1	0	0	0
5017_B	0	0	1	1	1	0	0	0	0
5036_A	0	0	1	1	0	1	0	0	0
5036_B	0	1	1	0	0	1	0	0	0
5036_C	0	1	1	0	0	1	0	0	0
5058_A	0	0	1	0	0	0	0	0	1
5058_B	0	0	1	0	0	0	1	0	1
5059	0	1	0	0	0	0	0	1	0
5057	0	0	1	1	0	0	0	0	1

Table 4. Mathematical Acquisition and Competencies Matrix

In table 4, the mathematical competencies referred to as M1, M2, M3 and M4 represent "Communication and Association", "Transformation into Mathematics", "Reasoning and Strategy Development" and "Use of Symbolic and Technical Language", respectively. Similarly, the acquisitions given as K1, K2, K3, K4 and K5 indicate "Forming Algebraic Expression", "Application of Field Information", "Application of Volume Information", "Knowledge of Conceptual Ratio" and "Application of Volume Information", respectively.

### The Actual Application of the Test

2834 students took part in the actual application of the Observation-4 test. In consequence of the analyses, the average score was 3,34 while the median value was 3 for the test. It can be seen that the standard deviation value is 1,57 and the variance value is 2,48. The skewness and kurtosis values are 0,29 and -0,01, respectively.

When the item difficulty and item distinguishing values of the Observation-4 test are analysed, it can be deduced that item difficulty values are range from 0,02 to 0,74 while item distinguishing values vary between 0,23 and 0,54. For this test, average item difficulty value was calculated to be 0,37 while average item distinguishing value was 0,41. Considering these values, it can be asserted that the test was demanding for most of the students.

### Procedure

The error matrix was used to identify what error types were in question when a student could not give a correct answer. In order to achieve this, the questions that were answered correctly and incorrectly on the dataset were inversed. That is, a reverse dataset were produced by inverting correct answers coded as 1 to 0 (no error) and incorrect answers coded as 0 to 1 (error). The analyses based on this new dataset and error matrix offered an output concerning the learning deficiencies and inadequacies of students.

#### **Data Analysis Techniques**

The data obtained in this study were analysed with the use of the following statistical methods in a way to produce answers to determined sub-problems. DINA 1110 module was used on OxEdit (Jurgen A. Doornik, 2018) software for the DINA model parameters and latent class posterior estimations. On the other hand, IBM SPSS 23 software was employed for correlation (Spearman's Rank Order Correlation) and hypothesis tests (ANOVA).

### FINDINGS

As a result of the DINA model analysis, the averages of error matrix, mathematical competencies matrix and mathematical acquisition matrix were 0.519, 0.257 and 0.237, respectively, for the g parameter. Similarly, the averages of the same were 0.21, 0.424 and 0.437 respectively, for the s parameter. The inverse relationship between the error matrix and other matrices result from the inversion of correct and incorrect answers. It can be suggested that this is a consistent result in terms of the applied procedure.

When we look at the correlation among the total error numbers determined according to the total scores and error profiles of the students in the Observation-4 test, we see that there is a high negative relationship ( $r_s =$ -0,802; P < 0,01). Accordingly, there was also a high negative relationship between the total error numbers and mathematical competency levels ( $r_s =$ -0,767; P < 0,01), and between the total error numbers and mathematical acquisition levels ( $r_s =$  -0,846; P < 0,01). All these conclusions indicate that the error profiles of the students have a consistent relationship with the total scores obtained and mathematical acquisition and competency levels.

One-way analysis of variance (ANOVA) was used to determine whether the latent classes under which the student were grouped according to their error analyses made any difference in their total test scores.

Variance Source	Sum of Squares	Degree of Freedom	Average of Squares (Variance)	F
Intergroup	4482.09633	3	1494.032	
Intragroup	2563.26712	2830	0.905748	1649,5**
Total	7045.36344	2833		
**p<0,01				

Table 5. One Factor ANOVA Results

In consequence of the One Factor ANOVA analysis, the F value was found to be 1649,5. The F value was calculated as 3 for intergroup analysis and 2830 for intragroup analysis. The examination on the degrees of freedom showed that there was a significant difference in 99% confidence level. For further analysis, Dunnett C test was applied to determine which groups showed significant difference among each other.

Post-hoc analyses produced that there was a difference among the latent classes that had 0, 1, 2 and 3 different types of error numbers. This analysis concluded in favour of the 000 error latent class. Accordingly, there was a difference among the latent classes that had 1, 2 and 3 different types of error numbers. This analysis resulted in favour of the 100, 010 and 001 error latent classes. Finally, there was a difference among the latent classes that had 2 and 3 different types of error numbers. The analysis resulted in favour of the 110, 101 and 011 error latent classes. It was inferred that total test scores of the students differed according to the number of the types of errors in their error profiles and that such difference brought less number of errors (F = 1649.5; P < 0.01).

The analyses and comparisons demonstrated that the tests prepared in line with Cognitive Diagnostic Models could offer error profiles as well as cognitive profiles of students. It was inferred that the error profiles that were created complied with the cognitive profiles, acquisition profiles and total test scores.

Therefore, we think that it would be beneficial to add the data obtained from the error profiles of students to mathematical feedbacks. Theoretically, including the data from error profiles in feedbacks will provide more and diverse information to students and enhance their performance better compared to the feedbacks based on the data from cognitive profiles alone. Due to the foregoing, we believe that error matrices should also be taken into consideration in Cognitive Diagnostic Models.

Considering the difficulty and development costs of measurement activities in educational environments, there have been countless studies with the intention to get multi-dimensional information about a student and, processing these data, to give more efficient feedback using a single application. This study aims to offer a new perspective for both CDMs which provide a new statistical approach in education and the approaches that aim to get multi-dimensional information about a student. Due to the complex structure of this study and the limited examples to the application of the models, the results of this study should be regarded as a suggestion for future studies rather than offering definitive findings. In this sense, these results aim to emphasize the significance of the studies regarding the structure of a quality measured as part of test development processes as well as the comprehensive analyses to be performed on results of measurements. In addition to the identification of the skills of students who provide correct answers to questions, we believe that the process should also necessarily include the inadequacies of those who give incorrect answers. Finally, we think that the measurement tools which are designed and developed in this manner will possibly produce multi-dimensional and in-depth feedbacks about individuals who take tests and that such data can be statistically inspected.

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# A STUDY ON 3D GEOMETRIC MODELING OF THE T.A. VITALI'S SOL MINOR CHACONNE IN VARIATION FORM WORKS

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## INTRODUCTION

Music is an aesthetic whole consisting of sounds combined with a certain purpose and method and processed according to a certain understanding of beauty (Uçan, 1994). It is believed that it was the Ancient Greeks who developed the first theories of music. In Ancient Greece, where music and dance played an important role in people's lives, it is known that poets sing epics accompanied by lyre. The word music is derived from the name of the Musees, believed to be the goddesses of art in ancient Greece. In the meantime, the word mousike was defined as a general term used for every branch of art or science under the protection of Muses (Mann & Newson, 2000).

Music includes a variety of mathematical structures, from the most basic to the most complex. Music and mathematics are two interrelated disciplines in many respects. Mathematics, on the other hand, parallel to his research on the competence and accuracy of intellectual knowledge, aesthetically also investigates the accuracy of affective knowledge, that is, beauty. The beauty inherent in mathematics is very important for mathematicians, and it is called the aesthetics of mathematics. Perspective, ratio, symmetry, order, harmony can be measured in all conditions. Art also has measurable aspects, which include the numbers of nature with mathematically expressed symmetry. These concepts constitute the aesthetics of mathematics. Measurements related to these concepts can be formulated in various areas of expertise in mathematics. The principles of mathematics are used in the examination of perspectives, proportions, shapes and symmetries, which are the basis of art and science. Therefore, the use of mathematical rules is not only useful, but also a necessity (Atalay, 2006).

Until today, many philosophers, mathematics and music people have been researching the relationship between these two disciplines, and the mathematical structure of music has been tried to be understood. Generally, some musical concepts such as diatonic and chromatic sequence, intervals, rhythm, measure, form, melody, chords, sequence, octave equivalence, nativities, timbre, acoustic, equally spaced sound system and alternative methods of accord are mathematically explained (Wright, 2009).

It is known that the shape of many musical instruments is also related to mathematical concepts. For example; The shapes of stringed or wind instruments are similar to the graph of  $x \ge 0$  and  $y = 2^x$  exponential curve. The study of the quality of musical sounds was made by the mathematician J. Fourier in the 19th century. Fourier proved that the musical instrument and all musical sounds emanating from human beings can be defined with mathematical expressions and this can be done with periodic sinus functions (Orhan, 1995).

The piano keys allow visual explanation of the connection between the Fibonacci series (1,1,2,3,5,8,13,21,34, ...) and the music created by the Italian Mathematician L. Fibonacci. An octave on the keyboard represents the musical interval between two notes, one higher than the other. The frequency of the higher note is twice the lower one. The keyboard is divided into one octave, 5 black and 8 white keys, with a total of 13 keys. Five black keys are divided into two groups, one double and one triple. 2, 3, 5, 8 and 13 are Fibonacci Numbers. Thirteen notes in octave form make up the chromatic sequence, the most popular range in Western music. The chromatic sequence. For example, the big six are composed of do and la notes, respectively, they make 264 and 440 vibrations per second, 264/440 = 3/5 is a Fibonacci ratio. A small hexadecimal range consists of the notes mi and do and vibrates 330 and 528 per second 330/528 = 5/8Fibonacci ratio (Koshy, 2001).

The ratio of two consecutive numbers in the Fibonacci sequence is approximately  $\phi = 1.61804$ , called the golden ratio. Golden ratio is a classification of art and aesthetics as a measure of harmony and beauty. The golden ratio is a biological fact that exists in nature, without being caused by human design, and it is known to be used in music. Musical instruments are also often made based on the number  $\phi$ . As with the violin design, Fibonacci Numbers and  $\phi$  were used in the design of the high quality vocal cord. In addition, it is assumed that many famous composers (Mozart, Beethoven, Bach, Chopin, Béla Bartók, ...) use Fibonacci Sequence and Golden Ratio in their works and it is tried to be proved. For example, it was proved that Mozart used the golden ratio in the works of No1.K.279, No2.K.280, No7.K.309, No10.K.330, No15.K.545, No16.K.570. In addition, there are composers who use the Fibonacci series consciously and indicate it (Lehmann and Posamentier, 2007).

The feature that distinguishes musical sounds from noise is that musical sounds have the feature of giving a distinctive pitch. The pitch is the parameter of the sound, which shows information about the level of treble. The criterion of the perception of a screen related to a sound is the degree of periodic (term) of that sound. With the ability of human beings to hear and imitate the sound they hear, the music obtained from the melodic and beautiful audio sequences is based on certain basic concepts. These basic concepts can be explained with classical music theory and terminology at the first stage. Just like visually complex forms in music, music is an aesthetic form of auditory perception. Fractal is defined as a form that repeats itself within a specific mathematical formula. Fractal geometry is to provide a mathematical explanation for the complex forms of the forms that exist in nature. In 2015, Beytekin applied the logic of Fractal Geometry algorithm to the modern jazz theory, analyzed the harmonies without mixing the rhythm phenomenon and created the visual models of the jazz chords. Design processes have established connections between the models created and psychological perception processes (Beytekin, 2015).

"Tomaso Antonio Vitali (March 7, 1663 – May 9, 1745) was an Italian composer and violinist from Bologna, the eldest son of Giovanni Battista Vitali. He is known mainly for a chaconne in G minor for violin and continuo, which was published from a manuscript in the Sächsische Landesbibliothek in Dresden in Die Hoch Schule des Violinspiels (1867) edited by German violinist Ferdinand David.

Vitali studied composition in Modena with Antonio Maria Pacchioni, and was employed at the Este court orchestra from 1675 to 1742. He was a teacher, whose pupils included Evaristo Felice dall'Abaco, Jean Baptiste Senaillé, Girolamo Nicolò Laurenti and Luca Antonio Predieri. Authentic works by Vitali include a set of trio sonatas published as his opus numbers 1 and 2 (1693), sonatas da camera (chamber sonatas), and violin sonatas (including his opus 6) among other works. Among those that have been recorded include all of the op. 1 (on Naxos 8.570182), three of the violin sonatas (on the Swiss label Gallo), and some of the sonatas from the opp. 2 and 4 sets (opus 4, no. 12 on Classica CL 101 from Finland.) He died at Modena.

A chaconne is a musical form used as a vehicle for variation on a repeated short harmonic progression over a ground bass. The Chaconne was marked by the copyist, at the time of transcription, in the upper margin of the first page of the Dresden manuscript as "Parte del Tomaso Vitalino" (Tomaso Vitalino's part), who may or may not be Vitali. Despite musicological doubts, the piece has been ever popular amongst violinists. For example, Jascha Heifetz chose it, in a "very much arranged and altered version", with organ accompaniment, to open his New York debut in Queen's Hall on 5 May 1920. Arrangements of it exist for violin and piano by Ferdinand David and by Léopold Charlier, for violin and organ, for violin and orchestra by Ottorino Respighi, and there are transcriptions of it for viola and piano by Friedrich Hermann (1828-1907) and by Alan Arnold (contemporary American violist and music publisher, owner of "Viola World Publications") and for cello and piano by Luigi Silva" (wikipedia.org).

Starting with a noble passion in Adagio tempo, 3/2 time signature and G minor tonality, the work continues with emotional or enthusiastic arpeggios that exhibit the characteristics of the violin technique. It is distinguished with its rich harmony and balanced colours. Although it develops in the form of Chanonne and variations, new ideas are always heard with an endless energy as if it were improvised. The 238 measure piece is a corner stone for virtuoze violinists (Actuary, 2004).

Mathematical coding and analysis of musical works, analysis of the works by means of computer-aided software, production of different approaches and providing opportunities for working between the disciplines are considered useful. In this sense, it is seen as an innovative approach to transform the abstract sounds into a tangible by transferring them to a geometric environment, and to perform structural analyses by considering the height and duration values of the sounds that make up the works in different combinations. The aim of working with this perspective; Vitali's Chaconne is the formed of the 3D geometric model of the violin party of the through mathematical coding.

### METODOLOGY

In this study, regression analysis of the mathematical coding of the note sound pitch and sound durations of the violin party of the Vitali's Chaconne was performed and the most appropriate geometric modelling was performed. Regression analysis is used to explain the relationship between a dependent variable and independent variables that are supposed to have an effect on a dependent variable with a mathematical model. Regression analysis examines the effect and direction of one or more variables (multiple regression) on another variable. In multiple linear regression analysis, beta values with standardized regression coefficients are used to determine the relative importance of independent variables with different measurement units and variances for the dependent variables. F and p values reveal the level of significance of the regression model established (Bayram, 2004).

Multiple regression analysis makes it possible to interpret the total variance explained in the dependent variable by the independent variables, the statistical significance of the explained variance and the direction of the relationship between the independent variable and the dependent variable (Büyüköztürk, 2002).

The data of this study was obtained by coding the note sound pitch and note sound values of the determined work. The work consists of a theme and 20 variations, after which the variations will be briefly shown as V1, V2, V3, ... V20. The distribution table of the note sound pitch that constitutes the work is given in Table 1 and Table 2 and the distribution table of the sound duration values of the work is given in Table 3 and Table 4.

Note Sound	Theme	V1	V2	V3	V4	V5	V6	<b>V7</b>	V8	V9	V10
<b>Pitch Values</b>	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν
-5									2		
-1									1		
0						7	1		3		
3		4						12	2		
4		1			1			11			
5									1		1
6		1		1	1		•••	12		•••	
7		2									
8	2	2					1	11			
9				1	2						
10	1	2		4			6		1	1	1
11	2	1		14	3		5	•••	3	•••	
12		1		1			1		3	11	
13		4	16	6	2		4	16	1	•••	1
14	1	1		4	3	2	•••	•••		•••	9
15	2	7	33	3		1	•••	26	1	12	19
16	2	6	1	3	3		2	4		•••	14
17	•••	2	•••	•••		2	•••	•••	2	31	30
18	1	6	1	6	3	8	8	3		6	7
19	4	3	17	5	2	•••	8	8	•••	•••	
20	12	8	12	1	•••	4	16	12	10	6	
21	2			3	1	4	5		9	9	4
22	8	8	19	1	6	-	2	11	18	14	14
23	4	6	17	3	17	8	1	8			
24	4		••••	•••		•••	•••	•••	8	12	16
25	6	2	5	•••	19	4	•••	•••	6	9	10
26		•••	•••	•••	15	6	•••	••••	2		•••
27	l	•••	•••	•••		2	•••	6	3	3	4
28	1	•••	•••	•••	10	2	•••	•••			
29				•••		1			2	6	1
<u>30</u>		•••		•••	3	1	•••	•••	1	•••	
51		•••		•••	•••	•••	•••	1		•••	
52	•••		•••	•••		•••	•••	•••	1	•••	
54 T. ( )			•••	•••		•••	•••	•••	1	•••	
lotal	53	67	121	56	91	52	_60	141	81	120	131

 
 Table 1. Distribution of Note Sound Pitch Values Forming the Theme and Variations Between 1 and 10

When Table 1 is examined, it is seen that the note sound pitch of the theme and variations from 1 to 10 have different definition ranges and a different number of notes are used. The most used sounds are **20** (23%, 12% and 27%) for Tema, V1 and V6, **15** (27% and 18%) for V2 and V7, **11** (25%) for V3, **25** (21%) for V4, **18** and **23** (15%) for V5, **22** (22%) for V8, **17** (26% and 23%) for V9 and V10. In addition, it was determined that **10** different sound combinations were used in V2, 12 in V9, **13** in V6, **14** in V5, V7 and V10, 15 in V3, **16** in Tema and V4, **19** in V1 and **22** in V8.

Note Sound	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20
<b>Pitch Values</b>	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν
-5						2	1		15	36
-3						1	1			
-2						1	1			
-1							1			
0			8			4				
1		•••	•••	•••	•••	1	3			•••
2		•••	•••	•••	•••			•••		1
3		•••	•••	•••	•••	6	9	•••	6	5
4	•••	•••	•••	•••	•••	3	4	•••	1	•••
5	•••	•••	•••	•••	•••	2	···· 2	•••	•••	•••
0 7	•••	•••	•••	•••		2 1	1	•••	•••	···· 2
8	•••	•••	•••	•••	6	7	3		•••	2
9	•••	•••	•••	•••	3	/	5	1	•••	2
10				2	3	3	4	1		2
11			3	7	4	4	6	2		2
12			4	6	2	2	2	4		
13				1	5	4	23	14		
14			5	7	3					2
15		•••	1	6	8	7	30	9	20	3
16	1	6	8	8	6	1	8	6	18	
17				1		1			•••	•••
18	1	6	12	6	6	2	4	•••	3	1
19	3		3	9			10	2	8	5
20	9	16	6	10	6	8	9	5	34	31
21	4	5	4	6	1				1	1
22	5		0	0	3	3	10	ð	5	9
23	0	25 1	<b>41</b>	0	Z	4	/	0	3 1	0
24	6	3	13	3	•••	1	 1	5	- -	8
25	0	1	15	5	•••	1	т	3	0	1
27		9	14	2		6	1	2	5	8
28		13	14					3	1	5
29		1						1		
30		8	9			1		2		
31						2		1		7
32		5	3			3				16
33		1								
34		••••				3				
35		1				1				
37		•••	•••	•••	•••		•••	•••	•••	3
43	•••	•••	•••	•••	•••	1	•••	•••	•••	•••
44 Tetel	•••					2	•••			
TOTAL	- 36	101	135	90	59	92	144	79	138	163

**Table 2.** Distribution of Note Sound Pitch Values Forming the Variations Between 11 and 20

When Table 2 is examined, it can be seen that the note sound pitch of the variations from 11 to 20 have different definition ranges and a different number of notes are used. The most used sounds are **20** (25%, 11%, 9%, 25% and 19%) for V11,V14, V16, V19 and V20, **23** (25% and 16%) for V12 and V13, **15** (14% and 21%) for V15 and V17 and **13** (18%) for V18. In addition, it was determined that **9** different sound combinations were used in V11, **15** in V12,V19, **17** in V14, **19** in V18, **22** in V20, **23** in V17 and **33** in V16.

Sound	Theme	V1	V2	V3	V4	V5	V6	5 V7	V8	V9	V10
Duration Values	Ν	N	N	N	N	N	Ν	N	Ν	N	Ν
1					1						
2	15	4		12	1	3	19	0	11		
3	3	0		3		2	2		2		
4	23	23		36	19	27	22	0	27		
6	4						1		1		
8	8	28	48	5	0	14	6		16	48	73
10		12	73		66			141	18	72	
12							4				
16					4	6	6		6		22
20											36
Total	53	67	121	56	01	52	60	1/1	<b>Q1</b>	120	131

 
 Table 3. Distribution of Sound Duration Values Forming the Theme and Variations Between 1 and 10

When Table 3 is examined, it is seen that the sound duration of the theme and variations from 1 to 10 have different definition ranges and a different number of notes are used. The most used sounds are **4** (39%, 64%, 52%, 37% and 33%) for Tema, V3, V5, V6 and V8, **8** (42% and 56%) for V1 and V10, **10** (56%, 73%, 100% and 60%) for V2, V4, V7 and V9.

Sound Duration	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20
Values	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν
1										1
2	23	1			4			4		10
3	1	2								2
4	10	5	8		11	3		6		20
5		3								
6		1			7	5		4		1
8	2	17	32	41	35	68		49		1
10		63		•••			144		138	
12					1					1
16			95		1	16				127
32								4		
36								12		
Toplam	36	92	135	41	59	92	144	79	138	163

**Table 4.** Distribution of Sound Duration Values Forming the Variations Between11 and 20

When Table 4 is examined, it is seen that the sound duration of the variations from 11 to 20 have different definition ranges and a different number of notes are used. The most used sounds are 2 (64%) for V11, 8 (100%, 59%, %74 and 62%) for V14, V15, V16 and V18, 10 (68%, 100% and 100%) for V12, V17 and V19, 16 (70%) for V13.

### **FINDINGS**

Note sound pitch (x) and sound duration values (y) of the work given in Tables 1,2,3 and 4 are taken as independent variables. In order to relate the cumulative time variable as a dependent variable, multiple regression analysis was performed to find statistical significance with some functions. Regression analysis tables regarding the note sound pitch and note duration values of the work are given below. In order to find out what percentage of the total change in the dependent variable is explained by the independent variables,  $R^2$  values was examined in Table 5 in the regression analysis and ANOVA (Analysis of Variance).

					ANOVA		
Variations	R	$\mathbb{R}^2$	Adjusted	Std. Error of the	F	p	
			$\mathbb{R}^2$	Estimate		P	
Theme	0,808	0,652	0,531	114,292	5,378	0,000	
V1	0,914	0,834	0,583	77,055	3,313	0,002	
V2	0,868	0,754	0,742	281,523	65,359	0,000	
V3	0,747	0,559	0,532	42,338	20,683	0,000	
V4	0,799	0,639	0,432	48,026	3,093	0,002	
V5	0,897	0,804	0,701	43,842	7,761	0,000	
V6	0,747	0,559	0,532	42,338	20,683	0,000	
V7	0,687	0,473	0,42	75,766	8,958	0,000	
V8	0,917	0,841	0,744	81,446	8,722	0,000	
V9	0,884	0,781	0,738	284,132	18,12	0,000	
V10	0,683	0,466	0,025	98,346	15,467	0,000	
V11	0,864	0,746	0,694	70,287	14,375	0,000	
V12	0,958	0,918	0,877	100,103	22,434	0,000	
V13	0,745	0,555	0,538	43,322	33,017	0,000	
V14	0,902	0,814	0,783	49,926	26,285	0,000	
V15	0,685	0,467	0,035	78,324	16,167	0,000	
V16	0,886	0,785	0,767	77,77	43,178	0,000	
V17	0,802	0,644	0,383	48,603	2,647	0,011	
V18	0,789	0,622	0,523	121,448	6,292	0,000	
V19	0,874	0,763	0,691	136,661	10,579	0,000	
V20	0,923	0,852	0,844	128,037	108,317	0,000	

 Table 5. Regression Models and ANOVA

As a result of the regression analysis in Table 5, the most suitable models among the many model suggestions for each Theme and Variation are given. The R<sup>2</sup> values of these models range from 0.466 (V10) to 0.918 (V12). According to these models, it is understood that the ratio between 46.6% and 91.8% is explained by the independent variables used for each model. In addition, when ANOVA part is examined, it is seen that regression models are all significant according to F and p values (p <0.05). Multiple regression analyses to determine whether the selected models are predictive are given in Table 6.

Variations	Model	В	Std.Error	Beta	t	р
	constant	236,454	25,040		21,460	0,000
Theme	tan10y	-19,885	4,249	-0,585	-4,680	0,000
	cosec3y	-40,034	12,346	-0,256	-3,043	0,003
3.7.1	$\frac{1}{y^2}$	751,474	264,802	0,375	2,838	0,009
V1	cos2x	82,472	29,608	0,473	2,785	0,011
	cosec5y	-62,687	24,834	-0,370	-2,524	0,019
	constant	1350,359	126,949		10,637	0,000
	cosec3x	12,255	3,371	0,181	3,636	0,000
	cos7x	252,666	55,360	0,330	4,564	0,000
	cos4y	172,975	70,594	0,123	2,450	0,016
V2	$x^2 + y^2$	-2,915	0,271	-1,715	-10,742	0,000
	$\sqrt{x^2+1}$	85,538	13,767	1,115	6,213	0,000
	$sin^2 6x$	-274,674	105,082	-0,193	-2,614	0,010
	constant	124,591	36,415		15,925	0,002
V3	sin9y	53,070	19,639	0,490	2,702	0,011
	secx	-5,747	2,950	-0,435	-2,071	0,039
V/	$x^{3} - y^{3}$	16,881	6,699	0,397	2,520	0,016
v 4	cosec9y	0,013	0,003	0,674	3,898	0,000
	constant	261,077	37,190		7,020	0,000
V5	sin5x	-32,183	11,339	-0,294	-2,838	0,008
	cos7x	-61,566	23,398	-0,481	-2,631	0,013
	tan5y	-14,678	4,230	-0,376	-2,997	0,005
	tan8y	12,312	5,701	0,274	2,160	0,038
	constant	129,568	8,136		15,925	0,000
VIC	sin10y	-39,065	8,546	-0,478	-4,568	0,000
VÖ	cosy	39,256	14,469	0,284	2,710	0,009
	sin6x	-37,346	10,252	-0,361	-3,643	0,001
	sin²8y	133,555	52,238	0,338	2,557	0,014
V7	$cos^2 3x$	174,757	58,376	0,419	2,994	0,005
• /	$sin(2^x)$	-58,135	25,402	-0,301	-2,289	0,027
	cosec5x	-8,548	4,034	-0,257	-2,119	0,040

 Table 6. Multiple Regression Analysis Regarding Prediction of the Model

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	constant	583,029	138,059		4,223	0,000
	cosec6y	56,316	15,397	0,401	3,658	0,001
V8	$\sqrt{y}$	-10,256	2,689	-0,488	-4,807	0,000
	cos2x	79,846	40,881	0,382	2,053	0,048
	tan4x	-147,565	71,663	-0,605	-2,059	0,042
	arctan9x	381,569	175,100	0,255	2,179	0,031
V9	cosxsiny	-2623,390	1416,264	-1,709	-2,352	0,022
	cosec7x	62,780	22,021	0,427	3,851	0,005
	$x^{3} - y^{3}$	-0,067	0,016	-0,886	-4,122	0,000
	constant	447,625	98,832		4,529	0,000
V10	sinxsiny	-202,446	132,667	-0,982	-2,126	0,043
	sin6x	-122,325	63,931	-0,715	-2,013	0,047
	constant	-862,496	138,920		-6,209	0,000
	$cos^27x$	93,847	33,774	0,286	2,779	0,008
V11	$cos^2 10x$	-208,880	44,091	-0,552	-4,737	0,000
	$\sqrt{y^2+1}$	149,946	17,435	0,744	8,600	0,000
	1					
	$\overline{y^3}$	301,781	55,822		5,406	0,000
	constant					
		301941,435	54610,159	0,378	5,529	0,000
	cos3x	90,960	26,514	0,228	3,431	0,001
	cos9x	-194,013	44,354	-0,512	-4,374	0,000
	tan3x	9,272	1,599	0,399	5,799	0,000
	tan4y	-44,811	12,216	-0,271	-3,668	0,001
V12	tan6x	17,780	5,017	0,201	3,544	0,001
	$cos(x^2)$	-136,329	49,253	-0,302	-2,768	0,008
	$cos^2 2x$	185,329	45,387	0,222	4,083	0,000
	cos²5y	-229,833	89,719	-0,145	-2,562	0,013
	cos²10y	495,728	62,559	0,464	7,924	0,000
	sec2x	-25,745	9,827	-0,261	2,620	0,012
	sec6y	25,803	9,057	0,170	2,849	0,006
	$x^{3} - y^{3}$	-0,011	0,001	-0,580	-9,531	0,000
	sin²8y	79,490	26,171	0,282	3,037	0,004
V13	$x^2 + y^2$	0,304	0,044	0,647	6,975	0,000

	constant	-236,188	61,399		-3,847	0,001
	tan8y	36,027	5,058	0,759	7,122	0,000
	sin3y	71,173	17,665	0,432	4,029	0,000
V14	$\sqrt{y}$	91,964	26,232	0,333	3,506	0,001
	sec2x	-48,651	11,224	-0,875	-4,335	0,000
	cos <sup>2</sup> 2x	232,537	65,875	0,742	3,530	0,001
V15	constant	447,625	98,832		4,529	0,000
V 1.5	sinxsiny	-202,446	132,667	-0,982	-2,126	0,043
	constant	380,035	10,373		35,851	0,000
	sec8y	17,779	2,618	0,483	6,797	0,000
	tan4x	-18,539	2,389	-0,443	-7,760	0,000
V16	cos6y	62,277	16,816	0,261	3,753	0,000
	sec7x	5,374	1,439	0,237	3,734	0,000
	tan6x	-8,585	3,797	-0,125	-2,261	0,027
	sinx	-34,369	17,023	-0,149	-2,019	0,047
	constant	124,591	36,415		15,925	0,002
V17	sin9y	53,070	19,639	0,490	2,702	0,011
V 1 /	secx	-5,747	2,950	-0,435	-2,071	0,039
	constant	494,127	106,995		4,618	0,000
	sin5x	192,379	44,438	0,556	4,104	0,000
V18	sin8x	94,513	35,592	0,339	2,655	0,011
	cos5x	56,661	21,948	0,270	2,582	0,013
	tan8x	37,221	8,403	0,627	4,428	0,000
	constant	1028,244	412,370		2,493	0,015
V10	sin3y	953,883	264,708	0,862	3,604	0,001
V 19	cos²6x	394,037	210,551	0,562	2,071	0,046
	sec4y	-90,015	29,751	-0,375	-3,026	0,003
	constant	-835,970	62,719		-13,329	0,000
	$y^2$	15,422	0,665	0,843	23,185	0,000
	sin2x	-127,140	19,599	-0,273	-6,487	0,000
V20	sec8x	-7,837	3,748	-0,096	-2,091	0,039
	$cos(x^2)$	82,108	23,143	0,182	3,548	0,001
	sec4x	-12,164	4,981	-0,114	-2,442	0,016
	sec10x	-23,813	10,577	-0,101	-2,252	0,026

When multiple regression analysis results related to predicting models proposed for Theme and Variation are examined in Table 6, it is seen that there is a significant relationship between Theme, V3, V5, V6, V10, V15, V16, V17, V18, V19, V20 and trigonometric functions. However, there is a significant relationship between V1, V2, V4, V8, V11, V12, V13, V14 and trigonometric-algebraic functions. In addition, there is a significant relationship between V9 and trigonometric-inverse trigonometric and V7 and trigonometric-exponential functions. According to the results in Table 6, z = z (x, y) regression equations, which are formed as the cumulative time dependent variable corresponding to the note sound pitch values = x and note sound duration values = y, are given in each of the following graphs. For the 3-dimensional geometric model of these regression equations obtained, Maple 13, which is one of the most trusted software in the world as a mathematical calculation, programming and modelling software, has been plotted. The drawn surfaces are given in the charts below.



z = 236 - 19tan10y - 40cosec3yChart 1. Geometric models and Regression equation of the Theme



Chart 2. Geometric models and Regresion equation of V1



z = -1350 + 12cosec3x + 252cos7x + 172cos4y $-3(x^{2}+y^{2}) + 85\sqrt{x^{2}+1} - 274sin^{2}6x$ 

Chart 3. Geometric models and Regresion equation of V2



z = 124 + 53sin9y - 5secxChart 4. Geometric models and Regression equation of V3



 $z = 17 cosec9y + 0,1(x^3 - y^3)$ Chart 5. Geometric models and Regression equation of V4



 $x = 261 - 32sin5x - 61cos7x - 14tan5y + 12tan8y + 0,1(x^3 - y^3)$ 

Chart 6. Geometric models and Regresion equation of V5



z = 129 - 39sin10y + 39cosy - 37sin6xChart 7. Geometric models and Regression equation of V6



 $z = 133sin^28y + 174cos^23x - 58sin(2^x) - 8cosec5x$ Chart 8. Geometric models and Regression equation of V7



 $z = 583 + 565 cosec 6y - 10\sqrt{y} + 79 cos 2x$ 

Chart 9. Geometric models and Regresion equation of V8



 $z = -147tan4x + 381arctan9x - 2623cosxsiny + 62cosec7x - 0,06(x^3-y^3)$ Chart 10. Geometric models and Regression equation of V9



z = 447 - 202 sinxsiny - 122 sin6xChart 11. Geometric models and Regression equation of V10



 $z = -862 + 93\cos^2 7x - 208\cos^2 10x + 149\sqrt{y^2 + 1}$ 

Chart 12. Geometric models and Regresion equation of V11



 $\begin{aligned} z &= 301 + 301941 \left(\frac{1}{y^3}\right) + 90 cos 3x - 194 cos 9x + 9 tan 3x - 44 tan 4y + 17 tan 6x \\ &- 136 cos (x^2) + 185 cos^2 2x - 229 cos^2 5y + 495 cos^2 10y - 25 sec 2x \\ &+ 25 sec 6y - 0,01 (x^3 - y^3) \end{aligned}$ 

Chart 13. Geometric models and Regresion equation of V12



 $z = 79sin^28y + 0.4(x^2+y^2)$ Chart 14. Geometric models and Regression equation of V13



 $z = -236 + 36tan8y + 71sin3y + 91\sqrt{y} - 48sec2x + 232cos^{2}2x$ Chart 15. Geometric models and Regression equation of V14



z = 445 - 205 sinxsinyChart 16. Geometric models and Regression equation of V15



x = 380 + 17sec8y - 18tan4x + 62cos6y + 5sec7x - 8tan6x - 34sinx Chart 17. Geometric models and Regression equation of V16



z = 124 + 53sin9y - 5secxChart 18. Geometric models and Regression equation of V17



z = 494 + 192sin5x + 94sin8x + 56cos5x + 37tan8xChart 19. Geometric models and Regression equation of V18



 $z = 1028 + 953sin3y + 394cos^26x - 90cosec4y$ Chart 20. Geometric models and Regression equation of V19



 $z = -835 + 15y^2 - 127sin2x - 7sec8x + 82cos(x^2) - 12sec4x - 23cosec10x$ Chart 21. Geometric models and Regression equation of V20

Charts 1 through 21 shows that geometrical modeling of the theme and 20 variations of the Vitali's accompaniment violin party, G minor Chaconne. The models shown in the charts reflect different melodic and rhythmic configurations of the theme and variations of the work. When the models formed with the notation of the theme and variations of the work are examined comparatively, it is observed that the 3D geometric models obtained are largely compatible with the work.

Within these regression models, 3D geometrical models forming the melodic and rhythmic lines of the work were found to be a combination of trigonometric functions for Theme, V3, V5, V6, V10, V15, V16, V17, V18, V19 and V20. However, it has been determined that it is a combination of trigonometric and algebraic functions for V1, V2, V4, V8, V11, V12, V13, and V14. In addition, it has been observed that trigonometric and inverse trigonometric functions for V9 and trigonometric and exponential functions for V7 are combined.

## **CONCLUSION AND SUGGESTIONS**

In this study, geometric modeling of G minor Chaconne, written by Tomaso Antonio Vitali (March 7, 1663 - May 9, 1745), which is one of the Baroque period composers of music in the history of music, was formed by mathematical coding. In the work, which was composed in the style of Chaconne (Variation), a total of 2010 sounds were used, with 238 measure, including theme and 20 variations. The selected work was coded according to the note sound pitch and duration values, and many 3D regression models were obtained after the regressions were made in the SPSS program.

The selected work consists of the theme and 20 variations, after which the variations will be briefly shown as V1, V2, V3,..., V20. Each of the themes and variations were individually encoded according to their note sound pitch and duration values, and the codings were made in SPSS program, and many three-dimensional regression models were obtained. Within these regression models, 3D geometrical models forming the melodic and rhythmic lines of the work were found to be a combination of trigonometric functions for Theme, V3, V5, V6, V10, V15, V16, V17, V18, V19 and V20. However, it has been determined that it is a combi-

nation of trigonometric and algebraic functions for V1, V2, V4, V8, V11, V12, V13 and V14. In addition, it has been observed that trigonometric and inverse trigonometric functions for V9 and trigonometric and exponential functions for V7 are combined.

The authors made some similar studies and the three-dimensional geometric model in these studies was found to have different equations. When geometrical modelling of Saygun's "Inci" piano piece is made, the equations of the three-dimensional geometric model that form the melodic lines of the piece are based only on the trigonometric function for two-layered right and left hand parties (Demirbatır and et al. 2018). In the geometric modelling of Saygun's Op.31 "Partita" solo cello, the 3D geometric model's equations were found to be algebraic, trigonometric and inverse trigonometric (Demirbatır et al. 2020). In the geometric modelling of the A minor two-voice invention (BWV 784), one of Bach's educational works, the 3D geometric model's equations were observed to consist of a combination of algebraic, trigonometric, inverse trigonometric and exponential functions (Demirbatır et al. 2020). Accordingly, it can be seen that different functions and models can be created for each piece's melody, rhythm, form, texture and processing.

It is thought that further analysis and analysis of musical works through different methods, analysis and modelling through mathematical coding will contribute to the field in terms of both disciplines. The works of composers who write works in different periods and styles of music history can be analysed through geometric modelling. Approaches of composers' understanding of composing can also be examined in this way. At the same time, different methods and techniques that can be applied in this field, analysis and geometric modelling methods can be developed.

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