

THE RELATION OF PROFESSIONAL ACTION COMPETENCE IN
EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) TO
SUSTAINABILITY TEACHING OUTCOME EXPECTANCY, ESD VALUE AND
TEACHER SELF-REGULATION

by

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B.S., Science Education, Boğaziçi University, 2021

Submitted to the Institute for Graduate Studies in
Science and Engineering in partial fulfillment of
the requirements for the degree of
Master of Science

Graduate Program in Mathematics and Science Education
Boğaziçi University

2024



ACKNOWLEDGEMENTS

First and foremost, I am sincerely grateful to my advisor, Assoc. Prof. Sevda Yerdelen-Damar, for her insightful suggestions, consistent and unwavering support that pushed me to keep moving forward. Your steadfast presence during moments of uncertainty provided invaluable guidance, deeply felt as I navigated through the process. Thank you for always being there when I needed support. I would like to extend my heartfelt thanks to my thesis committee members, Assist. Prof. Gaye Defne Ceyhan and Assoc. Prof. Yasemin Özdem Yılmaz for their constructive feedback and constant encouragement throughout the process. I would also like to thank Assoc. Prof. Serkan Arıkan for his expert guidance.

I would like to express my gratitude to Bahar Özay and Dr. Tamer Atabarut for their leadership in the 'Öğretmenler 2030: Sürdürülebilir Kalkınma Amaçları ve İklim Seferberliği Eğitimi'. I also extend my thanks to Boğaziçi University Lifelong Learning Center (BÜYEM), Schneider Electric, and the United Nations Sustainable Development Solutions Network (UN SDSN) for their collaborative role in organizing this training. The data from this program contributed to the adaptation of one of the scales in my study. Their assistance in gathering data from teachers during the adaptation of the scale in my study is gratefully acknowledged.

I would like to extend my deepest gratitude to my family. To my parents, Yasemin and Yüksel Aydın, thank you for encouraging me to keep going and lifting me through every challenge. To my aunt, Hülya Öz, thank you for always motivating me and reminding me what I'm capable of, particularly during the moments of greatest doubt. To my cousin, Ayşe Naz Öz, thank you for being one of my biggest sources of joy. To my grandmother, Ayserin Karaağaç, thank you for always being so supportive.

I am also profoundly grateful to my friends. I would like to thank my dearest friend, Kübra Kaya, for her endless support and uplifting words. Your friendship has

been a great source of strength and inspiration in my life. I also would like to thank my friends Melek Pesen, Mervenur Belin, Beyhan Ataş, Beyza Şirvan Ayaz, Berfin Huraibat and Arif Büyüksolak for their unwavering guidance and continuous support throughout this journey.

I am beyond fortunate to have had so many people that have guided and supported me throughout this journey. I am truly thankful for their contributions which significantly enriched the quality of this research.



ABSTRACT

THE RELATION OF PROFESSIONAL ACTION COMPETENCE IN EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) TO SUSTAINABILITY TEACHING OUTCOME EXPECTANCY, ESD VALUE AND TEACHER SELF-REGULATION

The aim of the study was to investigate in-service primary, middle and high school teachers' professional action competence in ESD (PACesd) and how sustainability teaching outcome expectancy, ESD value and teacher self-regulation predicted their professional action competence in ESD. This research's analysis comprised two parts. First part was assessing the validity and reliability of the adapted version of PACesd scale. A total of 302 in-service teachers participated in that stage of the research. Second part was conducting multiple regression analysis. 475 in-service teachers participated in that stage of the research. PACesd Scale, IMPesd Scale, Sustainability Teaching Outcome Expectancy Scale and Teacher Self-Regulation Scale were used to investigate research questions. Results showed that there were statistically significant differences in PACesd scores among in-service teachers teaching at different levels of education (i.e., primary, middle, high school). Furthermore, the model including ESD value, sustainability teaching outcome expectancy and teacher self-regulation were able to explain a large portion of variance in PACesd after controlling for the influence of education level in which in-service teachers teach. Also, the model containing ESD value, sustainability teaching outcome expectancy and teacher self-regulation was tested at each education level and it was found that the highest variance in PACesd was explained at primary school level, and it was followed by middle and then high school.

ÖZET

SÜRDÜRÜLEBİLİR KALKINMA EĞİTİMİNDE (SKE) MESLEKİ EYLEM YETERLİLİĞİNİN SÜRDÜRÜLEBİLİRLİK ÖĞRETİMİ SONUÇ BEKLENTİSİ, SKE DEĞERİ VE ÖĞRETMEN ÖZ DÜZENLEMESİ İLE İLİŞKİSİ

Bu çalışmanın amacı, ilkokul, ortaokul ve lise öğretmenlerinin sürdürülebilir kalkınma eğitiminde (SKE) mesleki eylem yeterliliklerini ve sürdürülebilirlik öğretimi sonuç beklentisi, SKE değeri ve öğretmen öz düzenlemesinin SKE'deki mesleki eylem yeterliliğini nasıl yordadığını araştırmaktır. Bu araştırmanın analizi iki bölümden oluşmaktadır. İlk bölümde, SKE'de mesleki eylem yeterliliği ölçeğinin uyarlanmış versiyonunun geçerliliği ve güvenilirliği değerlendirilmiştir. Araştırmanın bu aşamasına toplam 302 öğretmen katılmıştır. İkinci bölümde ise çoklu regresyon analizi yapılmıştır. Araştırmanın bu aşamasına 475 öğretmen katılmıştır. Araştırma sorularını incelemek için SKE'de Mesleki Eylem Yeterliliği Ölçeği, Sürdürülebilir Kalkınma Eğitiminin Algılanan Önemi Ölçeği, Sürdürülebilirlik Öğretimi Sonuç Beklentisi Ölçeği ve Öğretmen Öz-Düzenleme Ölçeği kullanılmıştır. Çalışmanın sonuçları, farklı eğitim kademelerinde görev yapan öğretmenler arasında SKE'de mesleki eylem yeterliliği puanlarında istatistiksel olarak anlamlı farklılıklar olduğunu göstermiştir. SKE değeri, sürdürülebilirlik öğretimi sonuç beklentisi ve öğretmen öz düzenlemesini içeren model, öğretmenlerin eğitim verdiği eğitim kademesinin etkisi kontrol edildikten sonra, SKE'de mesleki eylem yeterliliğindeki varyansın büyük bir kısmını açıklayabilmiştir. SKE değeri, sürdürülebilirlik öğretimi sonuç beklentisi ve öğretmen öz-düzenlemesini içeren model, her bir eğitim düzeyinde test edilmiş ve SKE'de mesleki eylem yeterliliğindeki en yüksek varyansın ilkokul düzeyinde açıklandığı, bunu ortaokul ve lisenin izlediği görülmüştür.

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LIST OF ACRONYMS/ABBREVIATIONS

AC	Action Competence
ACiSD	Action Competence in Sustainable Development
ESD	Education for Sustainable Development
IMPesd	Perceived Importance of ESD
PACesd	Professional Action Competence in ESD
SD	Sustainable Development
SDGs	Sustainable Development Goals

1. INTRODUCTION

Due to the idea of achieving prosperity and civilized living standards as long as people consume, societies around the world have continued to develop as consumer societies for a long time without paying attention to responsible consumption of resources, protection of nature and so on. This indifference to nature and the priority of unconditional growth has led to problems in many different dimensions, such as social, environmental, and economic. Currently, the idea that development should continue without harming nature and consuming resources inconsiderately became essential (Yücel and Kurnaz, 2021). As it is understood, the world needs sustainable development. The first modern definition of sustainable development was given in the Brundtland Commission's 'Our Common Future' report as development "meeting the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs." (Brundtland, 1987, p. 292).

The 2030 Agenda for sustainable development, aiming to lead humanity on a sustainable path, was approved by the United Nations (UN) General Assembly on 25 September 2015. The agenda's 17 Sustainable Development Goals (SDGs), along with its 169 targets to achieve by 2030, include the three dimensions (economy, social development and environment) of sustainable development (UN, 2015). To live in a more sustainable society and to be able to engage with issues on sustainability as explained in 17 goals, humans becoming sustainability change-makers is required. Individuals need to be informed, have the required skills, values and attitudes encouraging them to take part in sustainable development. In that sense, education is essential to accomplish sustainable development (Rieckmann, 2017).

Well established approach of Education for Sustainable Development (ESD) is explicitly acknowledged in the SDGs as Target 4.7 stating that "By 2030, ensure that all learners acquire knowledge and skills needed to promote sustainable development, including, among others, through ESD and sustainable lifestyles, human rights, gender

equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.” (UN, 2015, p. 17).

ESD has the purpose of developing individuals' competences that make them reflect on their own actions, considering their ongoing and upcoming cultural, social, environmental and economic influences, from a local and global point of view. In addition, they are aimed to be encouraged to act in a sustainable way during complex situations and take part in socio-political processes to make the societies move towards sustainable development (Rieckmann, 2017). Thus, raising capable and active citizens who are knowledgeable, willing to live in a sustainable manner and, act towards a more sustainable world is one of the primary purposes of ESD (Biasutti *et al.*, 2016; Carbach and Fischer, 2017). Since teachers are at the core of the implementation regarding ESD (Isac *et al.*, 2022), their ESD competences become very essential to raise action competent learners. In that regard, investigating predictors of teachers' ESD competence can promote insight into the development of their ESD implementation. Research mentions motivational and self-regulation factors to have relations with such competences (Baumert and Kunter, 2013; Bertschy *et al.*, 2013).

1.1. The Purpose of the Study

It's important to raise action competent students who are not only capable of recognizing and analyzing sustainability issues but also take necessary actions to deal with them. To raise action competent learners, there is a need for professionally action competent teachers in implementing ESD. Therefore, this study aimed to investigate in-service primary, middle and high school teachers' professional action competence in ESD (PACesd) and how sustainability teaching outcome expectancy, ESD value and teacher self-regulation predicted their professional action competence in ESD.

1.2. Significance of the Study

ESD aims to develop individuals' competences, which make them take action towards a sustainable future (Rieckmann, 2017). In this regard, teachers' competences play a key role in implementing ESD (Isac *et al.*, 2022). Research on teachers' competences in ESD is at the beginning stage (Sass *et al.*, 2022). In addition, when reviewing the literature, there are relatively less studies examining the competences of in-service teachers in the context of ESD or environmental education compared to those focusing on pre-service teachers (e.g. Effeney and Davis, 2013; Gardner, 2009; Saribas *et al.*, 2014; Soysal and Ok, 2022). It's recommended to study with in-service teachers, as they are more inclined to adopt new practices compared to pre-service teachers (Popova *et al.*, 2016). Furthermore, the studies on competences are predominantly done with teachers from primary school (e.g. Effeney and Davis, 2013; Gardner, 2009). However, involving teachers from higher education levels other than primary school is crucial as such teachers often face constraints imposed by subject-specific curricula, which hinder their ability to do interdisciplinary work (Borg *et al.*, 2012). In turn, primary school teachers are prone to find it simpler to integrate ESD into their teaching practices (Taylor *et al.*, 2019). Therefore, to work on ESD competences, it is important to include middle and high school teachers as well. To see how teachers from middle and high school teachers are challenged regarding the implementation of ESD depending on their subject areas, investigating teachers' competence based on the subject they teach becomes important (Isac *et al.*, 2022). Therefore, in this study, besides having investigated the potential differences among primary, middle and high school in-service teachers in terms of their ESD competences, potential differences among in-service teachers from different disciplinary areas in terms of their ESD competences were investigated as well.

Studies in literature predominantly focus on knowledge and self-efficacy of teachers in terms of their competences on the implementation of ESD or environmental education (e.g. Gardner, 2009; Moseley *et al.*, 2010) while willingness which is seen as an important competence component (Sass *et al.*, 2022; Vukelić, 2022) is generally

left out. Therefore, one of the basis of the study was the framework of Professional Action Competence in ESD (PACesd) developed by Sass *et al.* (2022), as it involves professional action competence in ESD, that is, self-efficacy, perceived pedagogical content knowledge and willingness regarding implementing ESD, of primary and secondary in-service teachers. This framework is also useful as it refers to ESD from a broader perspective by considering approaches holism, pluralism and action-orientedness (Sass *et al.*, 2022). Furthermore, in the model of action competence proposed by Sass *et al.* (2020), they consider self-efficacy involving two aspects: capacity expectation and outcome expectancy. When looked at their PACesd framework and the resulting scale, self-efficacy is considered teachers' confidence in their capacities. Therefore, the relation of outcome expectancy, confidence in producing desired effect when action is taken (Bandura, 1977), to PACesd was also examined in this study. In addition, the relation of ESD value was studied as it is another variable that is seen as a vital indicator of action competence of teachers (Bertschy *et al.*, 2013; Vukelić, 2022). Lastly, self-regulation's relation to PACesd was studied because it is considered crucial in promoting professional competences of teachers (Baumert and Kunter, 2013; Bertschy *et al.*, 2013; Vukelic, 2022). There are studies indicating a relation between teachers' self-regulation and self-efficacy (e.g. Bembenutty, 2007; Ghonsooly and Ghanizadeh, 2013). However, little is known for teacher self-regulation in the context of ESD. Also, little is known on the relationship of PACesd to sustainability teaching outcome expectancy, ESD value and teacher self-regulation. Therefore, aside from investigating PACesd, the relation of sustainability teaching outcome expectancy, ESD value and teacher self-regulation to PACesd was examined as well.

1.3. Research Questions

- Are there statistically significant differences in teachers' professional action competence in education for sustainable development among in-service teachers teaching at different levels of education (i.e., primary, middle, high school)?

- Are there statistically significant differences in teachers' professional action competence in education for sustainable development among in-service teachers from different disciplines?
- How well can professional action competence in education for sustainable development of in-service teachers be predicted by ESD value, sustainability teaching outcome expectancy, and teacher self-regulation?



2. LITERATURE REVIEW

In this section, because the core concept of the study is the professional action competence in ESD, action competence is introduced thoroughly at first. Then, connection is made among ESD, sustainability and action competence. Importance of teacher competence regarding the implementation of ESD is discussed since teachers are the participants of the research. Finally, both theoretical and empirical studies are presented related to teacher competence.

2.1. The concept of Action Competence (AC)

One of the main purposes of environmental education is to enhance learners' capability to take action - their action competence (AC) - regarding environmental issues (Jensen and Schnack, 1997). As Jensen and Schnack (1997) suggests environmental issues are deeply rooted in societal structures and our lifestyles. Therefore, addressing these issues necessitates changes at both the societal and individual levels. They consequently argued that the goal of environmental education should be to equip present and future citizens with the capacity to take action on both societal and personal levels. Thus, action competence refers to having the ability to effectively act regarding environmental issues as it encompasses the ability to critically analyze society and daily life to grasp the underlying causes of environmental issues, and to seek and implement solutions to these problems at both the individual and societal levels.

This notion of action competence was introduced and has taken up a pivotal area in the field of health and environmental education research within the work of Royal Danish School of Educational Studies' Research Centre for Environmental and Health Education (e.g. Breiting and Mogensen, 1999; Jensen and Schnack, 1997). Bishop and Scott (1998) suggested that action competence cannot be seen as a new concept since it has some association with scientific capability, practical reasoning and scientific literacy that have been addressed previously in the literature. Moreover, this

concept later entered the field of sustainable development (SD) and it is interpreted as individuals' latent capacity to take action for sustainability issues (Olsson *et al.* 2020).

Jensen and Schnack (1997) stated that 'competence' is connected to having ability and willingness to become a qualified participant. The concept 'action' is required to be understood within the context of various distinctions encompassing behavior, activities, movements, habits, and, thereafter, actions (Jensen and Schnack, 1997). To understand what underlies the concept of action competence, looking at the difference between behavior modification and action competence is essential. Related to the 'action' component in AC, there is consistently a deliberate decision-making process involved, while this isn't always true for behavioral changes, which could be prompted by external pressures such as those from teachers, peers, or advertisements (Jensen and Schnack, 1997). Behavioral approaches are commonly employed to affect or even control students into adopting pre-determined behaviors (Jensen, 2002). The concept of action suggests an intentional commitment in the individual taking action showing that they have considered the issue and made a decision to act. Frequently, the concept of behavior may not include this element (Breiting *et al.*, 2009).

It's also equally crucial to examine the distinction between action and activity to understand what's meant by action. To qualify as actions, they must be directed towards resolving the problem being studied (Jensen and Schnack, 1997). Another unique aspect of the action term is that any chosen action might be aimed at modifying the conditions/circumstances that led to the problem initially (Breiting *et al.*, 2009). Activity, in contrast, does not deal with the causes of the problem; instead, it solely focuses on addressing its symptoms (Jensen and Schnack, 1997).

So, as Jensen (2002) states, an action should be geared towards solving a problem and should be determined by those intending to execute the action. When contemplating the term "action," these two criteria should always be considered: intentionality/deliberate commitment, and addressing the root cause of the issue (Breiting *et al.*, 2009).

In essence, action competence combines the deliberate nature of action with the capability of competence. It requires both the capability and the practical execution of action towards a solution (Clark, 2016).

2.2. Studies on Action Competence (AC)

Action competence (AC) has been described in a variety of ways in the research area of educational sciences. In literature, AC is either seen as individuals' or groups' competence (e.g. Chawla and Cushing, 2007) while also referred to as an educational approach (e.g. Ellis and Weekes, 2008). Based on these views, Sass *et al.* (2020) recently redefined AC as “a competence of (groups of) individuals” (p. 294). Furthermore, several studies have pointed out the components of AC. For instance, Breiting and Mogensen (1999) have proposed that action competence consists of three key components which are knowledge of action possibilities, a wish to act and confidence in one's own influence. Additionally, Jensen and Schnack (1997) identified important components of AC as knowledge/insight, visions, commitment and action experiences.

As mentioned before, according to the theoretical framework regarding AC (e.g., Jensen and Schnack 1997; Mogensen and Schnack 2010), action relates to the behavior that is intentional and goal-oriented. Thus, it is volitional and aims for a change (Jensen, 2000) or finding a solution to controversial issues (Breiting *et al.*, 2009). Sass *et al.* (2020) argue that the volitional nature of action suggests that motivation to act should originate from within oneself, rather than being compelled into action by others. This highlights the concept of autonomous motivation, which encompasses volition and an individual's decisions about themselves (Sass *et al.*, 2020; Vansteenkiste *et al.*, 2006). In that regard, Sass *et al.* (2020) refer to the notion of acting with 'willingness,' which contains both autonomous motivation and commitment to taking action consciously. Based on the model by Moeller and Grassinger (2013) combining commitment and passion to point out behavioral persistence in goal-oriented activities, willingness is re-described as the commitment and passion to solve a problem (Sass *et al.*, 2020). Action involves addressing controversial and complex issues with the aim of finding solutions.

Therefore, as proposed by Sass *et al.* (2020), committed and passionate individuals also need to possess the necessary knowledge and skills in dealing with complex problems, thus becoming “qualified participants in democratic processes” (Breiting *et al.*, 2009, p. 57) that such problems demand. Likewise, knowledge about problems remains inactive and cannot transform into action without commitment (Jensen and Schnack, 1997). Moreover, Sass *et al.* (2020) proposed that confidence is also needed for knowledge to transform into action alongside the components willingness, knowledge and skills. They stated that the confidence needed for individuals to act encompasses two aspects of self-efficacy. The first aspect involves confidence in one’s capability to perform an action, as outlined in Bandura’s (2001) concept of capacity expectation. The second aspect is related to confidence in the belief that the action, when performed, will yield the desired outcome, reflecting Bandura’s (1997) notion of outcome expectancy.

Therefore, Sass *et al.* (2020) furtherly explored the subconstructs of action competence which include willingness, knowledge, skills, and confidence. Drawing from the work of Moeller and Grassinger (2013), they redefined willingness as passion and commitment to deal with a problem. This entails acquiring necessary knowledge about the problem and democratic processes (knowledge), adopting a critical but optimistic attitude towards various problem-solving methodologies (skills). In addition, they stated that confidence is necessary for AC. Individuals not only need to believe in their own capacity to influence outcomes, but also in their personal and collective capacity to change circumstances for the better. Based on the sub concepts of AC, Sass *et al.* (2020) determined the core aspects of an individual who is an action component. These core aspects include knowledge and skills, willingness (commitment and passion to make contribution), confidence as efficacy expectations and outcome expectancy. As they proposed, an individual is action competent when they are demonstrating commitment and passion towards addressing a societal concern, possessing necessary knowledge about the problem and democratic processes, adopting a critical yet constructive approach to various solutions, and have confidence in their skills and capacities to lead to a positive change.

2.3. Importance of ESD in fostering Action Competence

The 2030 Agenda for Sustainable Development was endorsed by the UN General Assembly on September 25, 2015 (UN, 2015). 17 Sustainable Development Goals (SDGs) are the center of the 2030 Agenda. The objective of these goals is to tackle global challenges and promote sustainable development across social, economic and environmental dimensions. These goals aim to ensure sustainable and prosperous life without leaving no one behind. Therefore, individuals must become the agents of sustainability change to foster a sustainable world and engage with issues outlined in the SDGs. This entails acquiring necessary knowledge, skills, attitudes and values encouraging them to actively make contributions to sustainable development which indicates that education plays an important role for the attainment of sustainable development (Rieckmann, 2017). In that regard, ESD which is explicitly acknowledged in the SDGs is essential as it enables learners to make informed decisions and undertake responsible actions to promote environmental health, economic viability and social justice for both current and next generations (Rieckmann, 2017). ESD provides the relevant knowledge and skills that empower learners to contribute to the achievement of SDGs. This enables learners not only to comprehend what SDGs are related to, but also to actively participate as informed citizens in fostering the transformation required (Rieckmann, 2017).

The concept of "wicked problems" was coined to describe complex issues that are difficult to define and lack straightforward solutions (Rittel and Webber, 1973). Sustainability issues can be viewed as "super wicked problems," characterized by their uncertainty, complex nature and the urgent need to address the issue (Lambrechts, 2020). Sustainability issues being these kinds of problems requires individuals not only possessing the knowledge and skills to exhibit certain sustainable behaviors but also having the competences to act upon these issues (Olsson *et al.*, 2022). Therefore, the focus of the learning outcomes aimed at enabling learners to tackle such problems should be on fostering the competences necessary to make well-informed decisions for action (Olsson *et al.*, 2020). In that sense, there has been growing scholarly focus on the

concept of AC for sustainability in the last decade (Chen and Liu, 2020; Varela-Losada *et al.*, 2016).

Individuals with action competence have the ability, motivation and intention to actively participate in seeking democratic solutions to issues regarding sustainable development (Mogensen and Schnack, 2010). They are able to critically examine societal problems, engage in decision-making processes, and collaborate towards sustainable solutions (Xing and Ironsi, 2024). Recently, in line with their redefinition of AC, Sass *et al.* (2020) addressed AC in the context of sustainable development. In that research, AC in Sustainable Development (ACiSD) specifically refers to individual/collective competence of people focused on dealing with sustainability issues. ACiSD was concluded with three sub-constructs which are willingness, self-efficacy and knowledge (Sass *et al.*, 2020). Action competent people are willing to, that is, committed and passionate about contributing to solving sustainability issues. Such individuals wish to take responsibility for both themselves and other people which contains being willing to articulate their perspectives and the actions they choose to take (Sass *et al.*, 2020). In terms of knowledge, action competent individuals possess the capability to acquire and build a comprehensive understanding regarding the sustainability issue at stake, encompassing its roots, causes, effects and stakeholders. Additionally, they must have the knowledge of democratic environmental policy making processes, as well as visionary and critical thinking skills. Lastly, such individuals have confidence in their own capacities to change the circumstances for a more sustainable world (Sass *et al.*, 2020).

Mogensen and Schnack (2010) have addressed that education should promote students' action competence development. Sass *et al.* (2020) have also advocated that education has a vital role in supporting individuals to become well-informed and have the ability to take action which is decided upon by themselves. In that regard, it is important to re-address that action is a behavior which is determined by who acts and is aimed towards solving an issue (Jensen and Schnack, 2006). Therefore, instead of making students modify their behavior towards predetermined solutions, education should make students capable of making conscious and informed decisions (Rudsberg

and Öhman, 2010) so that the goal of making current and future citizens having the ability to act on both personal and societal levels is met (Jensen and Schnack, 1997). In that sense, ESD is an educational approach aiming at empowering learners to take responsible action in complex situations to advance their communities towards sustainable development. (Rieckmann, 2017). Overall, the idea behind ESD strongly resonates with the concept of AC (Mogensen and Schnack, 2010). As Mogensen and Schnack (2010) addressed, although the concept of AC initially emerged in the context of environmental and health education, it also aligns with radical and democratic interpretations of ESD. They suggested that a significant role of ESD is to promote students to actively participate in finding democratic solutions towards sustainability issues. Likewise, Sandell *et al.* (2005) pointed out that ESD enables students to become knowledgeable in issues concerning SD and get skilled in handling related issues. Furthermore, Sass *et al.* (2020) have attributed ESD as an educational approach aiming to empower learners in cultivating the necessary AC in sustainable development (ACiSD), that is, willingness, self-efficacy and knowledge to engage in solving sustainability issues.

2.4. Importance of Teacher Competence in Implementing ESD

The instructional design implemented by teachers in class heavily influences students' learning (Sinakou *et al.*, 2019). As mentioned before, ESD is crucial in empowering learners to cope with sustainability issues to move towards a more sustainable world (Rieckmann, 2017). In that regard, research on ESD emphasized the important responsibility of teachers in organizing and delivering their instruction in such a way that enables students to obtain the knowledge, skills and competences needed to deal with sustainability issues (e.g. Olsson *et al.*, 2022; Rieckmann, 2017). Therefore, teachers are essential in assisting students to comprehend the complexity of sustainability issues and acquire the skills needed to address them (Hungerford, 2010). It is important to point out that implementing this complex educational approach is challenging to teachers and schools since it entails adapting a cross-curricular teaching approach embracing multiple points of views (Sass *et al.*, 2022).

Because sustainable development (SD) issues are regarded as complex due to the interrelations among the issues, different points of views and the interconnections among economic, social and ecological systems (Wuelser *et al.*, 2012), there are some approaches highlighted in the literature for the implementation of ESD. For instance, it was highlighted that ESD is an educational approach encompassing three essential components: holism, pluralism, and action-orientedness (Sass *et al.*, 2022). To begin with, a holistic perspective that integrates the economic, social and environmental aspects of SD is considered necessary (Sandell *et al.*, 2005). Öhman (2008) proposed three important aspects of holism: connecting and emphasizing interconnections among the social, environmental, and economic dimensions of sustainability issues, integrating past, present and future implications of these issues and focusing on them on a local, regional and global level. Teaching with a holistic approach involves recognizing the implications of sustainable development issues across all dimensions and acknowledging that these issues should be examined simultaneously across each dimension (Berglund and Gericke, 2016; Sinakou *et al.*, 2018). Besides this, the pluralistic perspective of ESD recognizes engaging in various views, perspectives and values while coping with sustainability issues (Lijmbach *et al.*, 2002; Rudsberg and Öhman, 2010). Teachers adopting pluralism encourage the democratic expression of diverse and frequently controversial perspectives, and foster complex problem-solving, to think critically and creatively, to make decisions collaboratively (Isac *et al.*, 2022). Moreover, the Action-oriented ESD framework proposed by Sinakou *et al.* (2019) is a recent conceptual framework describing the instructional practices teachers should implement. Teachers should be a guide and offer learners learning opportunities that equip them with the competences required to act collectively on SD issues (Sinakou *et al.*, 2019). It was furtherly proposed that teachers should not apply holistic and pluralistic approaches without action-orientation. If action-orientation is lacking, students can recognize and analyze sustainability issues without taking action to deal with them. On the contrary, if action-orientation is isolated from the other two approaches, students' actions would be decided by parents or teachers without students forming their own ideas (Sinakou *et al.*, 2019). These holistic, pluralistic and action-oriented teaching approaches in ESD all together are believed to be influential in cultivating students' action competence

which requires students take responsibility during the process of learning and in turn, lead them to take action effectively in coping with sustainability issues (Anyolo *et al.*, 2018; Sinakou *et al.*, 2019).

In conclusion, ESD calls for a pedagogy that prioritizes action-oriented, transformative teaching approach promoting self-directed learning, collaboration, problem-solving, participation, interdisciplinary and transdisciplinary methods as well as the integration of formal and informal learning (Rieckmann, 2017). During the implementation of ESD, teachers are required to enhance students' understanding of the complexity of sustainability issues involving society, economy and environment all connected together, accommodate diverse viewpoints to be addressed, foster critical thinking, encourage students to generate their own ideas, promote participation in decision-making processes, and empower them to take action (Boeve-de Pauw *et al.*, 2015; Evans *et al.*, 2017; Sinakou *et al.*, 2019). All of these things taken together, it is not an easy task for teachers to implement ESD (Sass *et al.*, 2022). The educational policy regarding sustainable development puts teachers and educators at all levels of education at the core of implementing ESD (Isac *et al.*, 2022). Teachers being at the core of implementation of ESD, the question on what competences teachers are required to possess to implement ESD successfully arises.

2.5. Research on Teacher Competence

2.5.1. Theoretical Studies on Teacher Action Competence in the context of ESD

Various theoretical studies have provided insights into teacher's competences in ESD in the literature. Based on the focus of this study, the most relevant ones are presented in the following.

To begin with, Weinert (2001), as cited in Baumert and Kunter (2013), coined the term 'professional competence', applying it to the particular ability to deal with

vocational demands. This term has subsequently been utilized in numerous research studies. Baumert and Kunter (2013) have developed a model of teachers' professional competence encompassing four aspects of professional competence that are professional knowledge, beliefs, motivation and self-regulation. In their model, the knowledge component can be categorized into five domains of knowledge including both content knowledge and pedagogical content knowledge. In terms of beliefs, epistemological beliefs, instructional goals in specific discipline and subjective theories of teaching and learning were focused on. Besides the cognitive characteristics that are knowledge and beliefs, they also considered non-cognitive characteristics that are motivational orientations and self-regulatory abilities to be the components of teachers' professional competence. Self-regulation was previously specifically emphasized as a significant component of teacher competence as well (Sleurs, 2008). Baumert and Kunter (2013) advocated that both motivational orientations and self-regulatory skills play an important role in understanding psychological aspects of behavior, sustaining intentions and managing and regulating occupational practice over time. They furtherly put forward that competence in a broader sense is seen to include the elements of motivation, self-regulation and metacognition which are deemed essential for inclination of willingness to act.

Building upon the structural foundation outlined by Baumert and Kunter (2013), in the context of ESD, Bertschy *et al.* (2013) proposed the model ESD-Specific Professional Action Competence of Teachers in Kindergarten and Primary School. They stated that action competence is viewed as an interaction of knowledge and ability with the components of motivation, conviction and value and self-regulation which serve as critical prerequisites for the willingness to act. Their model differentiates between two aspects of competence. One competence aspect is motivation and volition which merges Baumert and Kunter (2013)'s model's beliefs, self-regulation and motivation. Recognizing the significance of the regulatory concept of sustainable development and the role of education as a tool to deal with sustainability issues can be given examples of competences that motivation and volition refer to. As Vukelić (2022) indicates, regarding the motivation and volition in the model of Bertschy *et al.* (2013), the focus

lies on assessing ESD and perceiving the significance of attaining the goals of sustainable development through education. The other competence aspect is knowledge and ability related to the professional knowledge of Baumert and Kunter (2013)'s model. Bertschy *et al.* (2013) put forward that both content and pedagogical content knowledge are at the center of this aspect. In essence, they advocated that this competence is related to the acquisition of ESD-specific professional action competence, along with ESD-specific knowledge and a relevant pedagogical approach.

As Vukelić (2022) indicates Bertschy *et al.*'s (2013)'s model lacks the willingness component of AC because the theoretical framework of AC (e.g. Breiting *et al.*, 2009; Jensen and Schnack, 1997; Mogensen and Schnack, 2010) highlights that action is associated with intentional goal-directed behavior. In line with this idea, Vukelić (2022) advocated that if teachers have the intention to act in a specific manner, they are more likely to put that intention into action, so teacher's willingness (intention) regarding the implementation of ESD is a crucial indicator of teacher AC. Having willingness to act as a key element of AC and based on Bertschy *et al.* (2013)' model on professional AC of teachers, Vukelić (2022) proposed the model of Teacher Action Competence in ESD. Besides the willingness, the model includes knowledge and abilities which are content knowledge and pedagogical content knowledge concerning ESD. Moreover, it was stated that for knowledge to turn into action, self-regulation and motivational factors promoting teacher behavior are required (Vukelić, 2022). Such factors are included in teacher professional competences' key elements (Baumert and Kunter, 2013). These involve ESD value which Bertschy *et al.* (2013) identified as a pivotal indicator of AC of teachers, ESD self-efficacy, ascription of personal responsibility (Baumert and Kunter 2013; Vukelić, 2022). Thus, another element which is motivational beliefs having these three subcomponents was added to the model. While adding self-efficacy and ESD value subcomponents to the model, they also referred to the Expectancy-Value Theory (Eccles and Wigfield, 2002; Eccles, 2005) having the assumption that behavior is primarily affected by motivational beliefs that are the value assigned to the task and expectation of success. According to this theory, it can be concluded that key factors influencing teachers' engagement in ESD are their

evaluations of self-efficacy and ESD value (Vukelić, 2022). In the model of Teacher Action Competence in ESD, ESD value involves an evaluation of the importance of ESD within the education system, its significance in implementation, its adequacy, and its contribution to achieving SD goals (Vukelić, 2021). In conclusion, according to Vukelić (2022), a teacher with AC in ESD demonstrates an understanding of essential sustainable development content, acknowledges the importance of implementing ESD, and feels personally accountable for addressing sustainability challenges through the implementation of ESD. These teachers also have the pedagogical knowledge needed for ESD implementation, evaluate themselves as capable, and strategize responses to the challenges of the implementation of ESD.

Largely consistent with the studies above, there is another study proposed by Sass *et al.* (2022) which is the basis of this research. Sass *et al.* (2022) introduced the framework Professional Action Competence in Education for Sustainable Development (PACesd) stemming from the AC theories by Jensen and Schnack (1997), Jensen (2000), Breiting *et al.* (2009) and Sass *et al.* (2020). Building upon the AC concept, they proposed three fundamental features of PACesd that are necessary for teachers to implement ESD. In the previous study on AC, Sass *et al.* (2020) proposed that action competent individuals have passion and commitment, display confidence in their abilities to make contributions to solve issues while possessing the knowledge and skills required (Sass *et al.*, 2020). Sass *et al.* (2022) advocated that action competent teacher is needed to implement the complex educational approach ESD. The first core feature of the PACesd framework is the willingness that is the combination of commitment and passion. They used Moeller and Grassinger (2013)'s model that linked the concepts of commitment and passion since both terms describe why people continue in exerting effort and dedication towards difficult tasks despite negative experiences or facing obstacles. They also pointed out the further conceptualization of commitment by Moeller and Grassinger (2013) as to what extent an individual aligns with the goal set, has the intention to carry out particular behavior, and establishes long term objectives. Thus, they stated that willingness needs to be a strong form of autonomous motivation for school teams to persist their commitment in spite of the obstacles. Moreover, it was

previously argued by Sass *et al.* (2020) that confidence in an individual's capacities is linked to self-efficacy, particularly to capacity expectation that refers to what degree an individual has confidence in being capable of performing a particular action (Bandura, 2001). So, Sass *et al.* (2022) stated that teachers should have confidence required to implement ESD. Thirdly, they included knowledge of pedagogical approaches to be the necessary component. In essence, their framework includes willingness/passion-commitment of teachers/educators, their (pedagogical content) knowledge and skills and confidence/self-efficacy regarding implementing ESD. In this framework, ESD is based on a pluralistic, holistic and action-oriented approach to teaching learners on the ways they can make contributions to finding solutions to the problems related to sustainability issues. Since Sass *et al.* (2022) wanted to include non-formal educational areas, they preferred to call the framework 'professional' action competence instead of restricting it to 'teacher' professional action competence.

2.5.2. Related Empirical Studies

Besides theoretical studies, there are several empirical studies conducted to investigate teachers' competences in the context of ESD and environmental education. Gardner (2009) examined elementary pre-service teachers' self-efficacy in environmental education. It was found that pre-service teachers were aware of that they did not have enough knowledge and skills regarding environmental education. Likewise, Saribas *et al.* (2014) investigated elementary pre-service teachers' environmental knowledge and self-efficacy beliefs towards environmental education. They observed that their environmental knowledge and self-efficacy beliefs on environmental education were not sufficient. Malandrakis *et al.* (2019)'s study focused heavily on primary school student teachers' self-efficacy regarding ESD as a competence. According to their study, at the center of teachers' competence in implementing ESD lies their self-efficacy. Their study supports the idea of self-efficacy consisting of two elements that are efficacy expectation and outcome expectancy. The results showed that student teachers had moderate scores of self-efficacy regarding ESD which is in line with the results of Gardner (2009) and Saribas *et al.* (2014). Moreover, they found that there was a strong

correlation between self-efficacy and perceived knowledge which is supporting the findings of Effeney and Davis (2013)'s study who concluded in their research that increase in the perceived knowledge scores indicated higher levels of self-efficacy for pre-service primary teachers. In the literature, there are studies showing a relationship between self-efficacy and another variable that is self-regulation as well. For instance, Ghonsooly and Ghanizadeh (2013) suggested that self-efficacy and self-regulation are associated constructs based on existing theories and models in the literature. They carried out a study with teachers to investigate the relationship between their self-efficacy and self-regulation and found a significant relationship between them. Likewise, the study of Bembenuddy (2007) revealed that there is a high correlation between pre-service teachers' self-efficacy and self-regulated learning strategies. Returning to the research of Effeney and Davis (2013), it is important to highlight that there was no relationship to be found between self-efficacy and measured knowledge, and perceived and measured knowledge. In that study, in order to get a more profound understanding of pre-service teacher's competence in terms of teaching sustainability, Boon (2011)'s instrument was used. This instrument was developed based on Theory of Planned Behaviour (Ajzen and Fishbein, 2005) which suggests that behavior is affected by intention, which then affected by beliefs and attitudes. Effeney and Davis (2013) contextualized this scale for ESD as having the sub constructs of importance of ESD referring to attitudes in the study of Boon (2011) and self-efficacy regarding ESD referring to behavior and intention in the study of Boon (2011). Unlike the previous studies mentioned so far, the results of Effeney and Davis (2013)'s study showed that pre-service primary teachers had confidence in their capacity to engage with ESD and they considered ESD to be important. Moreover, Soysal and Ok (2022) investigated primary pre-service teachers' areas of competence that are knowledge, emotions, values-ethics, and systematic thinking on ESD. They found that Turkish pre-service teachers thought they were more competent in the emotions domain compared to other ones. Besides these, there are studies conducted to increase teachers' competences. For instance, Moseley *et al.* (2010) studied K-12 Teachers' teaching efficacy and outcome expectancy on environmental education and after the workshop they participated in, it was found that their environmental teaching efficacy and outcome expectancy increased. As seen from the

studies, they mainly focused on self-efficacy and knowledge as teachers' competences regarding the implementation of ESD or environmental education while teachers' willingness to implement ESD is not directly measured and often neglected (e.g. Gardner, 2009; Malandrakis *et al.*, 2019; Saribas *et al.*, 2014). Likewise, most research is carried out predominantly with pre-service teachers leaving in-service teachers behind (e.g. Bembenuatty, 2007; Effeney and Davis, 2013; Soysal and Ok, 2022). In addition, the number of studies done with primary school teachers is higher compared to secondary school teachers (e.g. Effeney and Davis, 2013; Malandrakis *et al.*, 2019; Saribas *et al.*, 2014). Besides these, unlike most of the research, ESD needs to be studied from a broader perspective by considering holism, pluralism and action-oriented approaches (Sass *et al.*, 2022).

Unlike previous studies that predominantly examined aspects of teachers' competence regarding ESD specifically among pre-service teachers (e.g. Effeney and Davis, 2013; Gardner, 2009; Saribas *et al.*, 2014) and teachers solely from primary education (e.g. Malandrakis *et al.*, 2019; Soysal and Ok, 2022), Sass *et al.* (2022) conducted a research focused on in-service teachers in both primary and secondary education. Currently, Sass *et al.* (2022) developed the PACesd scale which successfully measured and confirmed the validity of their framework PACesd and its underlying elements among in-service teachers from both primary and secondary education. The scale has three sub constructs in line with the PACesd framework. One of them is willingness to implement ESD which is associated with the commitment and passion of teachers regarding the implementation of ESD. Secondly, it measures perceived pedagogical content knowledge regarding ESD. Lastly, it includes self-efficacy concerning the ESD implementation which is related to confidence of teachers in implementing ESD principles (i.e. holism, pluralism, action-orientation). The development of the PACesd framework and scale expands the scope of investigation to encompass a wider array of competences beyond the self-efficacy and knowledge related to ESD that most studies concentrated on. Also, that framework facilitates the inclusion of secondary school teachers that have received less attention in the literature. Research indicates that integrating ESD into instructional practices is thought to be simpler for the primary school

teachers (Isac *et al.*, 2022). Establishing a centralized and holistic approach to ESD is relatively manageable in primary education, where a single teacher covers several subject areas. However, implementing ESD having the holistic and multidisciplinary nature can be more difficult in secondary school settings due to the diverse educational characteristics inherent in secondary education (Taylor *et al.*, 2019). Likewise, Borg *et al.* (2012)'s study indicated that implementing ESD in upper secondary education faces numerous obstacles associated with disciplinary boundaries as the subject-specification in such schools create obstacles to interdisciplinary work. Therefore, integrating ESD into the curriculum at the secondary level generally poses more challenges compared to doing so at the primary level (Taylor *et al.*, 2019). With the operationalization of the PACesd framework, as Sass *et al.* (2022) pointed out, it is enabled for schools and in-service teachers from primary and most importantly from secondary education to evaluate their strengths and areas for improvements in the implementation of ESD. Thus, PACesd framework and its scale makes it possible to involve in-service teachers in research as well. This is important as Popova *et al.* (2016) emphasize that it is significant to study with in-service teachers, as opposed to pre-service teachers, who generally adopt the existing culture of the school instead of implementing innovative practices. In the study of Sass *et al.* (2022), they also measured the teacher's perceived importance of ESD drawing from the study of Effeney and Davis (2013) mentioned above. They found that teachers' professional action competence in ESD and perceived importance of ESD are significantly related as high scores on one scale indicated high scores on the other scale. By using the PACesd instrument developed by Sass *et al.* (2022), Isac *et al.* (2022) carried out a study with in-service teachers in primary and secondary schools. In their study, they defined the AC as a fundamental competence possessed by teachers or groups of teachers who have the objective to integrate ESD into education practice.

So, they investigated in-service teachers' willingness, confidence in their abilities and perceived pedagogical content knowledge regarding the ESD implementation. Their results showed that there were differences between in-service teachers in primary and secondary education in terms of their professional action competence in ESD favor-

ing primary school teachers. Furthermore, it was found that primary school teachers' perceived PCK and willingness were higher in comparison to teachers in secondary schools.

2.6. Summary of the Literature Review

In sum, the concept action competence became the central focus within the Royal Danish School of Educational Studies' Research Centre for Environmental and Health Education (e.g. Breiting and Mogensen, 1999; Jensen and Schnack, 1997). Since then, this concept has been defined in various ways within the field of educational sciences. Sass *et al.* (2020) have recently redefined AC as “a competence of (groups of) individuals” (p. 294). Furtherly, they explored its sub-constructs as willingness, knowledge and skills, and confidence. Based on the literature presented above, AC is crucial for individuals to have the capacity to actively participate in dealing with sustainability issues that are considered as wicked problems. In doing so, they are able to make contributions to effectively transform their societies towards sustainable development. In that regard, ESD has a vital role in cultivating AC by equipping learners with required knowledge and abilities to comprehend sustainability issues and take responsible action accordingly. Because it is addressed that ESD is a complex educational approach to implement (Sass *et al.*, 2022) and teachers are at the core of implementing it (Isac *et al.*, 2022), it becomes essential to investigate competences teachers need to have in order to implement ESD successfully.

Looking at the theoretical studies, it was seen that Baumert and Kunter (2013)' teachers' professional competence model includes knowledge, beliefs, motivation and self-regulation components. Drawing from this, Bertschy *et al.* (2013)'s model encompasses motivation and volition combining Baumert and Kunter (2013)'s model's beliefs, self-regulation and motivation. Here, the emphasis is particular on evaluating ESD and recognizing the significance of achieving the goals of sustainable development through education. Their model also includes knowledge and ability associated with the professional knowledge of Baumert and Kunter (2013)'s model. When the theoret-

ical framework of AC (e.g. Breiting *et al.*, 2009; Jensen and Schnack, 1997; Mogensen and Schnack, 2010) was looked at, it can be concluded that this model lacked the willingness (intention) component. Vukelić (2022)'s model on teacher action competence included this component along with knowledge and abilities, ESD value, self-efficacy and ascription of responsibility. Sass *et al.* (2022)'s framework PACesd which is the basis of this study also has the willingness (commitment and passion) component along with (pedagogical content) knowledge and skills and confidence/self-efficacy regarding implementation of ESD.

Looking at the related empirical studies, they mainly focused on self-efficacy and knowledge as teachers' competences regarding the implementation of ESD or environmental education (e.g. Gardner, 2009; Malandrakis *et al.*, 2019; Saribas *et al.*, 2014) while teachers' willingness to implement ESD is often not directly investigated. Moreover, Effeney and Davis (2013) studied the importance of ESD besides the self-efficacy regarding ESD. Sass *et al.* (2022) also measured perceived importance of ESD in their study. Also, there are studies in the literature showing the relationship between teachers' self-efficacy and self-regulation (Bembenutty, 2007; Ghonsooly and Ghanizadeh, 2013), but they are not in the context of ESD. It can be seen that the majority of the studies conducted with pre-service teachers (e.g. Bembenutty, 2007; Effeney and Davis, 2013; Soysal and Ok, 2022). But, studying with in-service teachers is recommended as well since they are more prone to implement new practices compared to pre-service teachers (Popova *et al.*, 2016). In addition, the number of studies done with primary school teachers is higher compared to secondary school teachers (e.g. Malandrakis *et al.*, 2019; Saribas *et al.*, 2014). However, it is important to study with teachers from different educational levels as secondary school teachers have disciplinary boundaries while implementing ESD having interdisciplinary nature (Borg *et al.*, 2012) which often makes it more challenging for them to integrate ESD into their lessons compared to primary school teachers (Taylor *et al.*, 2019). Besides these, unlike most of the research, ESD needs to be studied from a broader perspective by considering holism, pluralism and action-oriented approaches (Sass *et al.*, 2022).

In conclusion, this study aimed to investigate professional action competence in ESD of in-service teachers in primary, middle and high schools. Therefore, PACesd framework developed by Sass *et al.* (2022) enabled to involve in-service teachers from different levels of education. This framework also enabled willingness regarding the implementation of ESD to be included in the study along with the other components perceived PCK and self-efficacy that are seen relevant in the context of AC of teachers. It also looks at ESD from a broader perspective by considering approaches holism, pluralism and action. Moreover, other variables including ESD value, sustainability teaching outcome expectancy and teacher self-regulation were added to the study based on studies presented above (e.g. Baumert and Kunter, 2013; Bertschy *et al.*, 2013; Sass *et al.*, 2020, 2022; Vukelić, 2022).

3. METHODOLOGY

This section discusses the methodology of the present research. The design of the research, participants, conceptual and operational definitions of the terms, concepts and variables, instruments used for data collection, procedure, internal validity and data analysis are presented below.

3.1. Research Design

A correlational study is one of the quantitative research designs and it involves identifying whether, and to what extent, the relationship exists among variables (Gay *et al.*, 2012). This study's research design is correlational design since the aim was to study how teacher self-regulation, sustainability teaching outcome expectancy and ESD value predicted in-service teachers' professional action competence in ESD.

3.2. Participants

Participants of the study were Turkish in-service primary school teachers, middle school teachers (science, social studies, technology and design, visual arts) and high school teachers (physics, chemistry, biology, geography teachers and visual arts). The curricula of the disciplines were examined and then disciplines were included in the study on the condition that they included sustainability and related concepts. Therefore, the purposive sampling method was used to select participants of this study as there was the criterion of selecting in-service teachers from particular subject areas. This study's analysis consisted of two parts: the validity and reliability analysis for the adapted version of PACesd and multiple regression analysis. Each part includes analyzing the data that was collected from the different groups of teachers at different times.

3.2.1. Participants for Adaptation

Barrett (2007), and Weston and Gore Jr. (2006) proposed that the sample size for Structural Equation Modelling (SEM) needs to be at least 200. Therefore, it was aimed to have at least 200 in-service teachers for the adaptation part. 302 in-service teachers participated in the first stage of the research. While 75.8 percent of these in-service teachers were female, 24.2 percent were male. Additionally, the highest participation rate belonged to middle school teachers with the percentage of 42.4 and they were followed by primary school teachers with 37.7%. The lowest participation was from high school teachers with 19.9%

3.2.2. Participants for Multiple Regression

Tabachnick and Fidell (2013) provide the formula $N > 50 + 8m$ (where m is equal to the number of independent variables) to determine sample size requirements. In that case, the minimum sample size required for this research was 74. Required sample size can be determined with power analysis as well. To determine a priori the number of subjects necessary per group to achieve a desired statistical power, power was established as 0.80 at the .05 significance level for the expected effect size on Gpower (Pituch and Stevens, 2016).

So, all the values were as follows: effect size as 0.02, as 0.05, power as 0.80 and number of predictors as 3. According to this, 550 in-service teachers for multiple regression analysis were required. As meaningful relations between the predictors and dependent variable was expected based on the literature, the researcher also set the magnitude effect size as medium. Thus, the same process was done for medium effect size that is 0.15. For this, 77 in-service teachers for multiple regression analysis were required. Therefore, relying on those required sample sizes, it can be claimed that sample size of the current study was appropriate for a regression analysis as in the study, a total of 475 in-service teachers participated in the second stage of the research. 64.4% of the participants were female while 35.5% of them were male. The highest

participation was from primary school teachers with 42.5%, then middle school teachers with 35.8%. The lowest participation was from high school teachers with 21.7%.

3.3. Definitions of Key Terms, Concepts and Variables

This section includes both conceptual and operational definitions of terms and variables related to the research.

3.3.1. Conceptual Definitions

- Sustainable development; It is the development “meeting the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs.” (Brundtland, 1987, p. 292).
- Education for sustainable development; ESD is a transformative and holistic form of education that involves the content and outcomes of the learning, pedagogy and educational setting. Thus, ESD not only incorporates topics like poverty, climate change and sustainable consumption in the curriculum, but also fosters student-centered, interactive teaching and learning environments (Rieckmann, 2017).
- Action competent individual; An individual is action competent when they are demonstrating commitment and passion towards addressing a societal concern, possessing necessary knowledge about the problem and democratic processes, adopting a critical yet constructive approach to various solutions, and have confidence in their skills and capacities to lead to a positive change (Sass *et al.*, 2020).
- Professional action competence in ESD; It includes willingness/passion-commitment of teachers/educators, their (pedagogical content) knowledge and skills and confidence/ self- efficacy regarding implementing ESD. In this framework, ESD is based on a pluralistic, holistic and action-oriented approach to teaching learners on the ways they can make contributions to finding solutions to the problems related to sustainability issues. (Sass *et al.*, 2022).

- ESD value; ESD value involves an evaluation of the importance of ESD within the education system, its significance in implementation, its adequacy, and its contribution to achieving SD goals (Vukelić, 2021).
- Outcome expectancy; It is defined as an individual's estimation that a given behavior will result in specific outcomes (Bandura, 1977).
- Self-regulation; It is conceptualized as "Self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals." (Zimmerman, 2000, p. 14).
- Teacher self-regulation; It is an active process in which teachers guide and sustain their motivation, metacognitive skills, and instructional strategies to improve their effectiveness in teaching (Capa-Aydin *et al.*, 2009).

3.3.2. Operational Definitions

- Professional action competence in ESD; The summated score of responses to the Professional Action Competence in ESD (PACesd) Instrument, based on a six-point Likert scale, from 1 = strongly disagree to 6 = strongly agree.
- ESD Value; The summated score of responses to the Importance of Education for Sustainable Development (IMPesd) Instrument, based on a six-point Likert scale, from 1 = strongly disagree to 6 = strongly agree.
- Sustainability Teaching Outcome Expectancy; The summated score of responses to the Sustainability Teaching Outcome Expectancy Instrument, based on a six-point Likert scale, from 1 = strongly disagree to 6 = strongly agree.
- Teacher Self-Regulation; The summated score of responses to the Teacher Self-Regulation Instrument, based on a six-point Likert scale, from 1 = strongly disagree to 6 = strongly agree.

3.4. Data Collection Instruments

3.4.1. Demographic Form

The demographic form was developed to gather information about the participants (See Appendix A). Questions pertaining to the participants' gender, school type and education level they work at, professional area, and teaching experience.

3.4.2. Professional Action Competence in Education for Sustainable Development (PACesd) Scale

Sass *et al.* (2022) developed the Professional Action Competence in Education for Sustainable Development (PACesd) Scale to measure teachers/educators' self-efficacy, perceived pedagogical content knowledge and willingness in the implementation of ESD. Cronbach's values of the sub-scales of self-efficacy, pedagogical content knowledge and willingness were found as 0.92, 0.94 and 0.96 respectively (Sass *et al.*, 2022).

The subscale of self-efficacy has ten items, the sub-scale of pedagogical content knowledge has 11 items, and the sub-scale of willingness has ten items. So, PACesd scale consists of 31 items in total and the respondents rate each item on a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The possible minimum score is 31 and the possible maximum score is 186 for the instrument and higher scores indicate higher professional action competence in ESD. This instrument was adapted to Turkish by the researcher of this study (see Appendix B).

3.4.3. Perceived Importance of Education for Sustainable Development (IMPesd) Scale

Sass *et al.* (2022) developed the Perceived Importance of Education for Sustainable Development (IMPesd) Scale drawing from Effeney and Davis (2013). In this research, it was used to measure ESD value. Cronbach's value of this scale was ob-

tained as 0.84 (Sass *et al.*, 2022). The instrument IMPesd scale has three items and the respondents rate each item on a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The possible minimum score is three and the possible maximum score is 18 for the instrument and higher scores indicate a higher value given to ESD in the educational area. This instrument was adapted to Turkish by the researcher of this study (see Appendix C).

3.4.4. Sustainability Teaching Outcome Expectancy Scale

Science Teaching Outcome Expectancy (STOE) scale, originally developed by Enochs and Riggs (1990) and adapted to Turkish by Tekkaya *et al.* (2004) measures pre-service science teachers' beliefs regarding the effectiveness of their teaching on the learning of students. Cronbach's α value of the Turkish version of Science Teaching Outcome Expectancy Scale was obtained as .76 (Tekkaya *et al.*, 2004).

The scale has ten items and respondents rated each item on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) in the study of Tekkaya *et al.* (2004). In this study, participants rated each item on a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). Also, the items of Science Teaching Outcome Expectancy Scale are rewritten for ESD by the researcher of this study (see Appendix D) and the content validity of the scale was ensured by two experts. The possible minimum score is 10 and the possible maximum score is 60 for the instrument and higher scores indicate high expectations in regard to the outcomes of sustainability teaching.

3.4.5. Teacher Self-Regulation Scale (TSRS)

Teacher Self-Regulation Scale (TSRS) was developed by Capa-Aydin *et al.* (2009) based on self-regulation model of Zimmerman and semi-structured interviews done with pre-service and in-service teachers. It has nine factors but, in this study self-instruction, self-evaluation, self-reaction and help-seeking were used. These sub-scales

were selected since they were compatible with the adopted framework and the related literature. Performance goal orientation, mastery goal orientation and emotional control that were not compatible with the scope of the research were left out after getting an expert opinion. Also, the items of goal settings and intrinsic interest overlapped with the items of the PACesd scale used in this study so, they were not included as well. Cronbach's values of the sub-scales self-instruction, self-evaluation, self-reaction and help-seeking were obtained as .78, .62, .66 and .78, respectively (Capa-Aydin *et al.*, 2009).

The scale has 15 items with the four factors used in this study and the respondents rated each item on a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The items of the Teacher Self-Regulation Scale are rewritten for ESD by the researcher of this study (see Appendix E) and the content validity of the scale was ensured by two experts. The possible minimum score is 15 and the possible maximum score is 90 for the instrument and higher scores indicate higher self-regulation in self-instruction, self-evaluation, self-reaction and help-seeking.

3.5. Procedure

First, the literature was reviewed to select the topic of the study and to formulate the research questions of the study. In this study, PACesd scale developed by Sass *et al.* (2022) was adapted into Turkish to measure in-service teachers' professional action competence regarding the implementation of ESD. Besides this scale, IMPesd scale developed by Sass *et al.* (2022) was adapted as well. During this process, permission for the adaptation was taken from Sass *et al.* (2022) as a first step. Then, forward translation, that is, translation of the scales from English to Turkish was done by the researcher of this study. Then, three experts evaluated the translation independently and the necessary changes were done after their recommendations. Experts and the researcher had a consensus that three items on PACesd were still needed to be clarified to adapt the items appropriately to the Turkish context so, Sass *et al.* (2022) were contacted. After their explanations on the items, these three items were rewritten ac-

cordingly. The new written items were also found to be suitable by the experts. As a pilot study, these versions were applied to 13 graduate students and their suggestions were taken. Later, the back-translation of the scales was done by two experts independently. These back-translated versions were shared with scale developers and changes were made according to their suggestions. Finally, an expert evaluated the scales in terms of the language and meaning and the required changes were made accordingly. The final Turkish versions of PACesd and IMPesd were applied to Turkish in-service teachers to test the factor structure of the scales in the Turkish context.

Second, to examine how teacher self-regulation, sustainability teaching outcome expectancy and ESD value predict in-service teachers' professional action competence in ESD, the four data collection instruments that are PACesd, IMPesd, Sustainability Teaching Outcome Expectancy and Teacher Self-Regulation Scales were administered to in-service teachers collectively.

Before collecting data for adaptation and multiple regression analyses, the required research permissions were obtained from the Ethical Committee of the Bogazici University (see Appendix F) and the Ministry of Education (see Appendix G). Participants' consents were taken via consent forms (see Appendix H and I). Participation was voluntary and participants were not asked to write their names and other identifying information. Only some demographic information (gender, school type and education level they work at, professional area, teaching experience) was collected. The collected data is stored in a locked file on the researcher's computer.

3.6. Internal Validity

This section outlines how the issue of internal validity was addressed.

In terms of subject characteristics threat, the process of selecting participants for research might result in differences among individuals/groups that are unintentionally associated with the variables being investigated (Fraenkel *et al.*, 2023). This threat was

dealt with as gender and teaching experience of teachers were included in the study. Mortality threat is about some participants dropping out during the research process (Fraenkel *et al.*, 2023). This was not the case as the data was collected at one time in each school. Participants' responses can be affected by location where instruments are administered (Fraenkel *et al.*, 2023). This was prevented by keeping the location the same for all participants. The instrument decay was controlled by collecting data in a way that minimizes changes (Fraenkel *et al.*, 2023). Data collector characteristics threat is about the characteristics of the data collector such as gender and age. This was controlled as the same researcher collected all the data (Fraenkel *et al.*, 2023). Also, data collector bias was prevented as all procedures were standardized (Fraenkel *et al.*, 2023). Testing threat is about participants figuring out the nature of the study due to the instrumentation process (Fraenkel *et al.*, 2023). This was avoided by ensuring that the context of the instruments did not influence the responses of other instruments. History, maturation, attitude of subjects, regression and implementation threats were not the case as well.

3.7. Data Analysis

3.7.1. Scale Adaptation

Confirmatory factor analysis (CFA) was conducted to test whether the Turkish form of the PACesd scale has three factor structure as in the original scale. CFA was conducted using Mplus 8.8 (Muthén and Muthén, 1998-2017). The same was done for IMPesd as well. Based on the modification indices, error variance was added between several items that assess the same dimension within each subscale. Cronbach's Alpha reliability coefficient was used to determine the reliability of the scale results.

3.7.2. Descriptive and Inferential Statistics

Prior to data analysis of the second stage of the study, the missingness was dealt with. The percentage of missing values per item ranged from .2 to .8. In that sense,

any technique to deal with missing values would give approximately same results. Therefore, data was organized based on disciplines of teachers via the split file section in SPSS. Then, item-based replacement of the missing values was done and in that way, all the participants could be included in the analyses.

Both descriptive and inferential statistics were carried out through SPSS 29. Descriptive statistics was conducted to summarize and organize the data of the current study. Additionally, inferential statistics was performed as some types of t-test and analysis of variance (ANOVA) were used to investigate the research questions. These statistical tests have various common assumptions which are the level of measurement, independence of observations, normal distribution and homogeneity of variance (Pallant, 2016). All these assumptions were checked performing the analyses below.

One-way between-groups ANOVA was used to examine whether there were statistically significant differences among in-service teachers teaching at different levels of education (primary, middle and high school) in terms of their PACesd scores which is the first research question of the research.

One-way between-groups ANOVA was used to investigate whether there were statistically significant differences among in-service teachers from various disciplines (primary, science, social studies, technology and design, visual arts, physics, chemistry, biology and geography teachers) in terms of their PACesd scores which is the second research question of this research.

Besides educational level and disciplines, the mean scores of PACesd were compared across different groups such as gender and teaching experience to see if there were any other relevant variables to be controlled while conducting the multiple regression analysis.

One-way between-groups ANOVA was used to examine whether there were statistically significant differences among in-service teachers having different years of teach-

ing experiences in terms of their PACesd scores. The independent-samples t-test was used to investigate whether there were statistically significant differences between female and male in-service teachers in terms of their PACesd scores.

Hierarchical multiple regression analysis was conducted to demonstrate how ESD value, sustainability teaching outcome expectancy and teacher self-regulation contributed to predicting PACesd while controlling for the influence of education level in which in-service teachers teach. Standard multiple regression analysis was performed to investigate how much variance in PACesd was explained by ESD value, sustainability teaching outcome expectancy and teacher self-regulation for each education level (i.e. primary, middle and high school). Preliminary analyses were performed to make sure that there were no violations of the assumptions of multiple regression. Before the hierarchical regression analysis, dummy variables were constructed from the education level teachers are teaching at (primary, middle and high school) to incorporate it into the hierarchical multiple regression model. Because this categorical variable has three groups, the number of dummy coded variables that can be constructed from that categorical variable is 2. Being a high school teacher was treated as a reference group meaning that zeros were assigned to that group across the two dummy variables. For the first dummy variable (being primary school teacher), 1 assigned to being primary school teacher while 0 assigned to other two groups. For the second dummy variable (being middle school teacher), 1 assigned to being middle school teacher while 0 assigned to other two groups. These two dummy variables were entered in Block 1 and again these two dummy variables along with other variables (ESD value, sustainability teaching outcome expectancy and teacher self-regulation) were entered in Block 2 in the hierarchical multiple regression analysis. Before the standard multiple regression analysis, the data file was split into three separate groups according to the education level teachers are teaching at in order to get analysis for these three groups separately.

4. RESULTS

This section presents the results of the study. First, descriptive statistics results are given for the data collected for adaptation and then CFA and Reliability analyses are discussed. Then, the results of descriptive and inferential statistics are presented for the data collected to investigate research questions of this study.

4.1. Adaptation Results

4.1.1. Descriptive Statistics of the data in the Adaptation Study

Table 4.1 shows the demographic information of participants. It also includes the mean and standard deviations for the PACesd and IMPesd scales that were adapted to Turkish.

Table 4.1. Descriptive statistics for adaptation groups.

Groups	Dimensions	<i>N</i>	<i>M</i>		<i>SD</i>	
			PACesd	IMPesd	PACesd	IMPesd
Gender	Female	229	121.5	14.6	32.7	3.83
	Male	73	121.0	13.4	33.9	4.1
Education Level	Primary School	114	120.8	14.0	35.3	4.2
	Middle School	128	121.2	14.5	31.2	3.8
	High School	60	122.7	14.4	32.3	3.8
Teaching Experience	1-5 years	78	121.6	14.4	32.0	3.8
	6-10 years	74	117.4	14.2	33.2	4.0
	11-15 years	66	122.0	14.5	33.0	4.1
	16 years and more	82	125.0	14.3	33.7	4.0
Disciplines	Primary	114	120.5	14.0	35.2	4.2
	Science	73	118.0	15.0	29.0	3.4
	Social Sciences	36	130.0	14.2	29.3	3.9
	Physics	12	128.1	14.6	30.4	3.8

Table 4.1 Descriptive statistics for adaptation groups. (cont.)

Groups	Dimensions	N	M		SD	
			PACesd	IMPesd	PACesd	IMPesd
	Biology	14	126.2	15.1	26.1	2.7
	Chemistry	10	106.8	13.3	34.8	3.6
	Geography	21	120.2	14.0	35.5	4.5
	Visual Arts	11	140.4	15.8	24.6	3.7
	Technology and Design	11	113.4	14.0	46.5	5.7

4.1.2. Confirmatory Factor Analysis (CFA) and Reliability Analysis of the Turkish versions of the PACesd and IMPesd scales

302 in-service teachers participated in the adaptation process of the study. For validity analysis, CFA was performed using Mplus 8.8 (Muthén and Muthén, 1998-2017) to assess whether the factor structures in the original scales fit the data gathered from Turkish teachers (Urdan, 2010). Multiple fit indices that are Comparative Fit Index (CFI), Tucker–Lewis index (TLI) and Root Mean Square Error of Approximation (RMSEA) were used to assess the goodness of the fit of data gathered for the hypothesized model based on the following criteria; $CFI \geq 0.90$, $TLI \geq 0.90$, and $RMSEA \leq 0.08$ were considered as an acceptable fit, and $CFI \geq 0.95$, $TLI \geq 0.95$, and $RMSEA \leq 0.05$ were considered as an excellent fit (Hu and Bentler, 1999; Marsh *et al.*, 2013).

For PACesd scale, after including error variance between a few items, multiple fit indices were found to be within the acceptable value range ($CFI = 0.94$, $TLI = 0.93$, $RMSEA = 0.08$, (%90 CI = 0.074; 0.085)).

Table 4.2 shows the factor loadings for each subscale of PACesd. Instrument's standardized factor loadings ranged from 0.74 to 0.93 for Factor 1; 0.79 to 0.94 for Factor 2; and 0.69 to 0.91 for Factor 3. All the factor loadings were higher than the critical limit of 0.32, which is recommended by Pituch and Stevens (2016). All the

items of PACesd were significantly loaded onto the hypothesized factors so correlations between items and factors were significant ($p < .05$).

Table 4.2. Factor loading results for PACesd.

Factor	Indicator	Estimate
1.Self-efficacy regarding ESD	Item 1	0.74*
	Item 2	0.88*
	Item 3	0.81*
	Item 4	0.89*
	Item 5	0.93*
	Item 6	0.86*
	Item 7	0.80*
	Item 8	0.85*
	Item 9	0.82*
	Item 10	0.74*
2.Perceived PCK about ESD	Item 11	0.85*
	Item 12	0.80*
	Item 13	0.79*
	Item 14	0.89*
	Item 15	0.93*
	Item 16	0.94*
	Item 17	0.94*
	Item 18	0.93*
	Item 19	0.87*
	Item 20	0.86*
	Item 21	0.85*
3.Willingness to implement ESD	Item 22	0.69*
	Item 23	0.86*
	Item 24	0.86*
	Item 25	0.89*
	Item 26	0.88*
	Item 27	0.91*
	Item 28	0.90*
	Item 29	0.89*
	Item 30	0.89*
	Item 31	0.89*
Note. * $p < 0.05$		

Figure 4.1 shows the factor structure of the Turkish version of the scale. It has three factors as in the original scale.

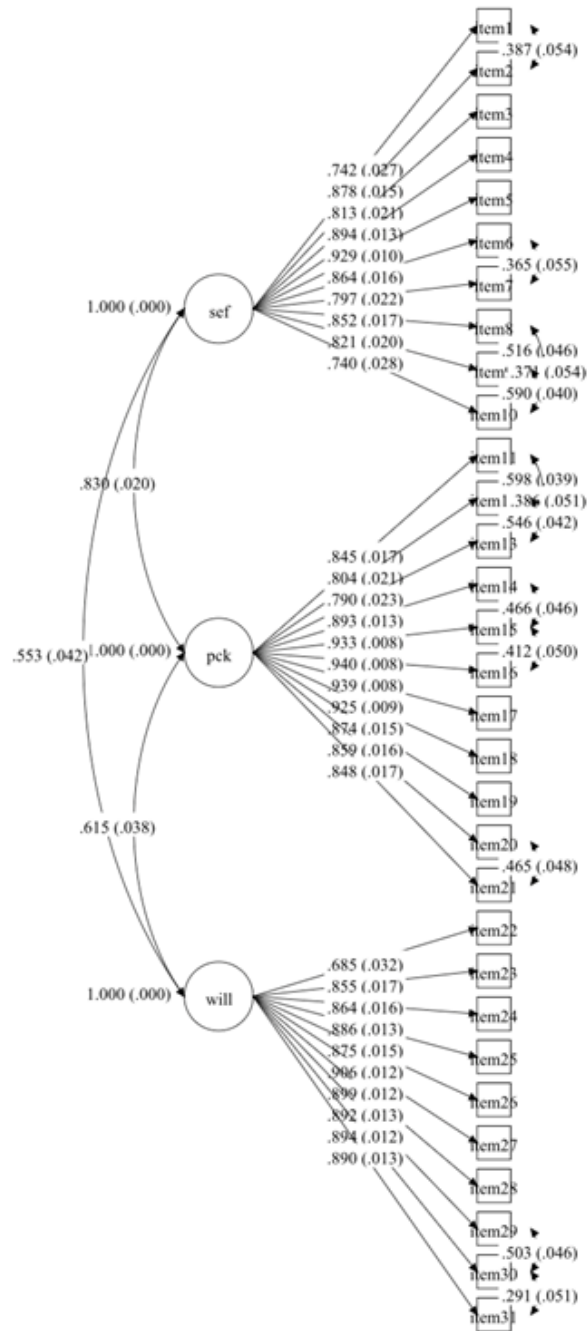


Figure 4.1. Factor structure of PACesd Scale. sef: self-efficacy, pck: perceived PCK, will: willingness.

As seen in the Table 4.3, PACesd scale has excellent internal consistency, with a Cronbach alpha coefficient reported of .98. The reliability value was found as 0.96 for self-efficacy regarding ESD, 0.98 for perceived PCK about ESD and 0.97 for willingness to implement ESD indicating excellent internal consistency (Cicchetti, 1994).

Table 4.3. Reliability statistics for PACesd.

	Cronbach's Alpha	N of items
PACesd Scale	0.98	31
Sub-scale		
Self-efficacy	0.96	10
Perceived PCK	0.98	11
Willingness	0.97	10

For IMPesd scale, multiple fit indices indicated an excellent fit (CFI = 1.00, TLI = 1.00, RMSEA = 0.00, (%90 CI =0.000; 0.000)).

Table 4.4 shows the factor loadings for IMPesd. Instrument's standardized factor loadings ranged from 0.89 to 0.96, higher than the critical limit of .32, which is recommended by Pituch and Stevens (2016). All the items were significantly loaded onto the hypothesized factors so correlations between items and factors were significant ($p < 0.05$).

Table 4.4. Factor loading results for IMPesd.

Factor	Indicator	Estimate
Factor 1	Item 1	0.89*
	Item 2	0.95*
	Item 3	0.96*
Note. * $p < 0.05$		

Table 4.5 indicates that IMPesd scale has excellent internal consistency with a Cronbach alpha coefficient reported of (Cicchetti, 1994).

Table 4.5. Reliability statistics for IMPesd.

	Cronbach's Alpha	N of items
IMPesd Scale	0.95	3

4.2. Results Related to Research Question 1

The first research question was about investigating statistically significant differences in teachers' professional action competence in ESD among in-service teachers teaching at different levels of education (i.e., primary, middle, high school). One-way between-groups ANOVA was carried out to compare the mean scores of professional action competence in ESD of in-service teachers based on education levels. Assumptions of this statistical test were checked. Normal distribution assumption was met since the scores of dependent variables are normally distributed for each group. Level of measurement was assumed as the dependent variable was continuous. Independence of observations was also not violated as teachers answered the questionnaires individually. Lastly, homogeneity of variance was checked which provides the Levene's test evaluating whether variation in scores is consistent across all groups (Pallant, 2016). The significance value for Levene's test being .076 which is higher than .05 indicates that the assumption of homogeneity of variance was not violated (Pallant, 2016).

Descriptive statistics results are given in the Table 4.6. As seen from the table the highest mean score belongs to primary school in-service teachers while high school had the lowest mean score.

Table 4.6. Descriptive Statistics for PACesd among in-service teachers from different education levels.

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Confidence Interval (95%)</i>	
				<i>Lower Bound</i>	<i>Upper Bound</i>
PACesd					
Primary School	202	127.6	33.6	122.9	132.2
Middle School	170	124.6	33.4	119.6	129.7
High School	103	115.1	28.2	109.6	120.6
Total	475	123.8	32.7	120.9	126.8

As seen in the Table 4.7, there was a statistically significant difference in PACesd scores for the three groups: $F(2, 472) = 5.1, p = .006$. In addition, the effect size which is the Eta squared value was .021 showing small to medium effect (Cohen, 1988).

Table 4.7. One-way analysis of variance summary table comparing education levels on PACesd.

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Education Levels					
Between Groups	2	10739.6	5369.8	5.107	0.006*
Within Groups	472	496282.5	1051.4		
Total	474	507022.2			
Note. * $p < 0.05$					

A post hoc analysis was conducted to identify significant differences between pairs of groups in terms of their PACesd scores. Table 4.8 shows the results of the post-hoc test. According to that table, primary school teachers' ($M = 127.6, SD = 33.6$) scores were statistically significantly higher than high school teachers ($M = 115.1, SD = 28.2$). Also, middle school teachers' ($M = 124.6, SD = 33.4$) scores were statistically

significantly higher than high school teachers ($M = 115.1$, $SD = 28.2$). There were no statistically significant differences between primary and middle school in-service teachers in terms of their PACesd scores.

Table 4.8. Multiple Comparisons based on the education levels of in-service teachers.

Variable			Mean Difference	<i>SE</i>	<i>p</i>
PACesd					
	Education Levels of Teachers				
	Primary	Middle School	2.9566	3.3750	0.656
	School	High School	12.4477	3.9260	0.005*
	Middle	Primary School	-2.9566	3.3750	0.656
	School	High School	9.4912	4.0489	0.051*
	High	Primary School	-12.4477	3.9260	0.005*
	School	Middle School	-9.4912	4.0489	0.051*
Note. * $p < 0.05$					

4.3. Results Related to Research Question 2

Second research question was about investigating statistically significant differences in teachers' professional action competence in ESD among in-service teachers from different disciplines. One-way between-groups ANOVA was carried out to compare the mean scores of PACesd of in-service teachers based on professional areas. Assumptions were checked and normal distribution, level of measurement and independence of observation were not violated, same with the research question one. However, since the significance value for Levene's test was 0.033 which was less than .05, the assumption of homogeneity of variance was violated (Pallant, 2016). So, variances vary across groups meaning that the variability of scores within each group is not similar.

Descriptive statistics results are given in the Table 4.9. As seen from the table the highest mean score belongs to primary school in-service teachers while chemistry in-service teachers had the lowest mean score.

Table 4.9. Descriptive statistics for PACesd among teachers from different disciplines.

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Confidence Interval (95%)</i>	
				<i>Lower Bound</i>	<i>Upper Bound</i>
PACesd					
Primary	203	127.9	33.8	123.2	132.5
Science	82	126.3	29.2	120.0	132.8
Social Sciences	45	125.1	31.7	115.6	134.6
Physics	23	116.8	28.4	104.6	129.1
Biology	25	115.5	29.3	103.4	127.6
Chemistry	25	110.1	29.7	97.9	122.4
Geography	24	114.8	27.0	103.5	126.2
Visual Arts	17	114.7	29.5	99.5	129.8
Technology and Design	31	123.6	44.1	107.5	139.8
Total	475	123.8	32.7	120.9	126.8

As the homogeneity of variance was violated, Pallant (2016) suggests looking at the results of the robust tests Welch and Brown- Forsythe. As seen in the Table 4.10, the significance values for each test were not significant ($p = 0.059 > 0.05$ and $p = 0.070 > 0.05$) meaning that there were no statistically significant differences across all groups in terms of their PACesd scores. Additionally, the effect size, eta squared, was .029 which indicates small to medium effect (Cohen, 1988).

Table 4.10. Robust tests of equality of means for disciplines on PACesd.

	<i>Fa</i>	<i>df1</i>	<i>df2</i>	Sig.
Welch	1.962	8	99.4	0.059
Brown-Forsythe	1.842	8	226.0	0.070
Note. a. Asymptotically F distributed. *p<0.05				

4.4. Investigation of Possible Extraneous Variables

Besides the disciplines and education levels, one-way between-groups ANOVA was carried out to compare the mean scores of PACesd of in-service teachers based on teaching experiences (1-5 years, 6-10 years, 11-15 years and 16 years and more). This was done in order to control this variable during the multiple regression analysis in case the results are significant. The assumptions that are normal distribution, level of measurement, independence of observation were assumed. Likewise, homogeneity of variance was not violated as the significance value for Levene's test was .078.

Descriptive statistics results are given in the Table 4.11. Teachers having 11-15 years of teaching experience reported highest mean score ($M = 127.7$, $SD = 32.1$) and teachers having 1-5 years of teaching experience had the lowest mean score ($M = 118.9$, $SD = 31.6$).

Table 4.11. Descriptive Statistics for PACesd among in-service teachers having different years of teaching experience.

Variable		<i>N</i>	<i>M</i>	<i>SD</i>	<i>Confidence Interval (95%)</i>	
					<i>Lower Bound</i>	<i>Upper Bound</i>
PACesd						
	1-5 years	154	118.9	31.6	113.8	123.9
	6-10 years	113	126.2	29.9	120.7	131.8
	11-15 years	87	127.7	32.1	120.9	134.5
	16 years and more	98	123.4	38.2	115.7	131.1
	Total	452	123.4	32.9	120.3	126.4

A one-way between-groups analysis of variance was conducted to explore the impact of teaching experience on professional action competence in ESD, as measured by PACesd scale. Participants were divided into four groups according to the level of education they are teaching at (Group 1: 1-5 years; Group 2: 6-10 years; Group 3: 11-15 years; Group 4: 16 years and more). As seen in the Table 4.12, there was no statistically significant difference at the $p < 0.05$ level in PACesd scores for the four groups: $F(3, 448) = 1.8$, $p = 0.154$. The effect size, eta squared, was .012 indicating small effect (Cohen, 1988). This variable wasn't controlled during the multiple regression analyses as the results were not significant.

Table 4.12. One-way analysis of variance summary table comparing teaching experience on PACesd..

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Teaching Experience					
Between Groups	3	5699.2	1899.7	1.762	0.154
Within Groups	448	493027.1	1078.2		
Total	451	488726.3			
Note. * $p < .05$					

For the same reason as the investigation of teaching experience, the independent-samples t-test was conducted to compare the PACesd mean scores for male and female in-service teachers. The assumptions that are normal distribution, level of measurement and independence of observation were assumed. Also, since the significance value for Levene's test is larger than 0.05 with the value of 0.056, equal variances were assumed (Pallant, 2016).

Based on the Table 4.13, there was no significant difference in scores for males ($M = 125.3$, $SD = 35.7$) and females ($M = 122.8$, $SD = 31.0$; $t(470) = -0.81$, $p = 0.419$, two-tailed). The magnitude of the difference in the means (mean difference = -2.55 , 95% CI: -8.75 to 3.65) was very small (Cohen's $d = 0.07$). This variable wasn't controlled during the multiple regression analyses as the results were not significant.

Table 4.13. Comparisons of females and males on PACesd. .

Variable		<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
PACesd							
	Females	306	122.8	31.0	-.809	470	.419
	Males	166	125.3	35.7			
Note. * $p < 0.05$							

4.5. Results Related to Research Question 3

Third research question was about investigating how well professional action competence in ESD of in-service teachers can be predicted by ESD value, sustainability teaching outcome expectancy and teacher self-regulation. Multiple regression analysis was conducted to examine how a group of independent variables collectively predict a continuous dependent variable (Pallant, 2016). In this study, two types of multiple regression were performed. Multiple regression can serve to statistically control for an extra variable/s while investigating a model's predictive ability (Pallant, 2016). Therefore, one of the types used was hierarchical multiple regression that involves sequential introduction of variables or groups of variables in steps or blocks, with each IV being evaluated according to its contribution to predicting the DV after previously included variables have been controlled for (Pallant, 2016). In this research, hierarchical multiple regression was used to assess the contribution of three predictors (teacher self-regulation, sustainability teaching outcome expectancy and ESD value) to the prediction of PACesd, after controlling for the influence of education level in which in-service teachers teach.

Other type used was standard multiple regression where each independent variable is assessed based on its capacity to predict DV, beyond the predictive ability offered by other IVs (Pallant, 2016). For this, there is the simultaneous entry of all independent variables into the model at once (Pallant, 2016). In this research, three

separate standard multiple regression analyses were employed to test how teacher self-regulation, sustainability teaching outcome expectancy and ESD value predicted in-service teachers' PACesd at each educational level (primary, middle, high school).

Additionally, it is important to point out that both sustainable teaching outcome expectancy and teacher self-regulation scales were found to have excellent internal consistencies with Cronbach alpha coefficients .91 and .97 respectively (Cicchetti, 1994).

4.5.1. Assumptions of Multiple Regression Analysis

There are several assumptions of multiple regression which are sample size, multicollinearity and singularity, outliers, normality, linearity, homoscedasticity and independence of errors (Pallant, 2016). These assumptions were checked for both types of multiple regression conducted.

Sample size: As mentioned above, 475 in-service teachers participated in the research. This was higher than the recommended value of Tabachnick and Fidell (2013) and the value calculated on Gpower with medium effect size. However, it was slightly less than the value determined with power analysis on Gpower with small effect size.

Multicollinearity and singularity: This assumption is related to relationships among IVs. When the correlation coefficient (r) is equal or higher than .9 between the independent variables indicating that they are highly correlated, multicollinearity exists (Pallant, 2016). In this research, as seen in Table 4.14 and Table 4.15, this was not the case. Therefore, there's no need to remove any independent variable from the model. Singularity was not an issue as there were not any independent variables that are the combination of other IVs (Pallant, 2016).

Table 4.14. Number of participants, means, standard deviations and correlations for hierarchical multiple regression analysis.

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	1	2	3
1. Professional Action Competence in ESD	475	123.8	32.7			
2. ESD Value	475	13.2	3.9	0.621*		
3. Sustainability Teaching Outcome Expectancy	475	41.4	10.0	0.678*	0.602*	
4. Teacher Self-Regulation	475	69.8	15.8	0.700*	0.664*	0.658*
Note. <i>N</i> , <i>M</i> and <i>SD</i> are used to represent number of participants, mean and standard deviation, respectively. * <i>p</i> <0.05.						

Table 4.15. Number of participants, means, standard deviations and correlations for standard multiple regression analysis for each education level teachers are teaching at.

Education Level	Variable	<i>N</i>	<i>M</i>	<i>SD</i>	1	2	3
Primary School	1. Professional Action Competence in ESD	202	127.6	33.6			
	2. ESD Value	202	13.3	3.7	0.718*		
	3. Sustainability Teaching Outcome Expectancy	202	42.2	10.2	0.779*	0.692*	
	4. Teacher Self-Regulation	202	70.6	16.1	0.748*	0.694*	0.736*
Middle School	1. Professional Action Competence in ESD	170	124.6	33.4			
	2. ESD Value	170	13.6	4.0	0.607*		
	3. Sustainability Teaching Outcome Expectancy	170	41.5	10.0	0.619*	0.546*	
	4. Teacher Self-Regulation	170	70.4	15.9	0.692*	0.614*	0.562*
High School	1. Professional Action Competence in ESD	103	115.1	28.2			
	2. ESD Value	103	12.6	4.1	0.449*		
	3. Sustainability Teaching Outcome Expectancy	103	39.6	9.5	0.523*	0.522*	
	4. Teacher Self-Regulation	103	67.3	15.0	0.587*	0.690*	0.645*
Note. <i>N</i> , <i>M</i> and <i>SD</i> are used to represent number of participants, mean and standard deviation, respectively. * <i>p</i> <0.05.							

Multicollinearity can be checked by Tolerance and VIF values as well (Pallant, 2016). Tolerance value lower than 0.10 and conversely, VIF value higher than 10 suggest

high multicollinearity. As seen in Table 4.16 and Table 4.17, the tolerance values are higher than 0.10 and VIF values are less than 10 indicating no multicollinearity. So, the multicollinearity assumption was not violated.

Table 4.16. Tolerance and VIF values of independent variables of hierarchical multiple regression analysis.

Variable	Collinearity Statistics	
	Tolerance	VIF
ESD Value	0.509	1.966
Sustainability Teaching Outcome Expectancy	0.516	1.939
Teacher Self-Regulation	0.454	2.202
Note. Dependent Variable: Professional Action Competence in ESD.		

Table 4.17. Tolerance and VIF values of independent variables of standard multiple regression analysis for each education level teachers are teaching at.

Education Level	Variable	Collinearity Statistics	
		Tolerance	VIF
Primary School	ESD Value	0.446	2.241
	Sustainability Teaching Outcome Expectancy	0.395	2.534
	Teacher Self-Regulation	0.393	2.546
Middle School	ESD Value	0.564	1.773
	Sustainability Teaching Outcome Expectancy	0.619	1.614
	Teacher Self-Regulation	0.550	1.818
High School	ESD Value	0.513	1.949
	Sustainability Teaching Outcome Expectancy	0.573	1.745
	Teacher Self-Regulation	0.412	2.425
Note. Dependent Variable: Professional Action Competence in ESD.			

Outlier: Tabachnick and Fidell (2013) suggests that outliers in a data set are described as cases possessing standardized residuals (as seen in scatterplot) exceeding 3.3 or falling below -3.3. If a small number of outliers exist outside this range, there is no need to eliminate any data points. According to the Figure 4.2, there were a few falling below -3.3 so, no data was removed. Additionally, to evaluate if outliers exert an excessive effect on the model's overall results, Cook's Distance value can be checked (Pallant, 2016). As Tabachnick and Fidell (2013) propose cases possessing values higher than 1 may pose a problem. In this study, the maximum value for Cook's Distance was .165 which indicated there were no major issues.

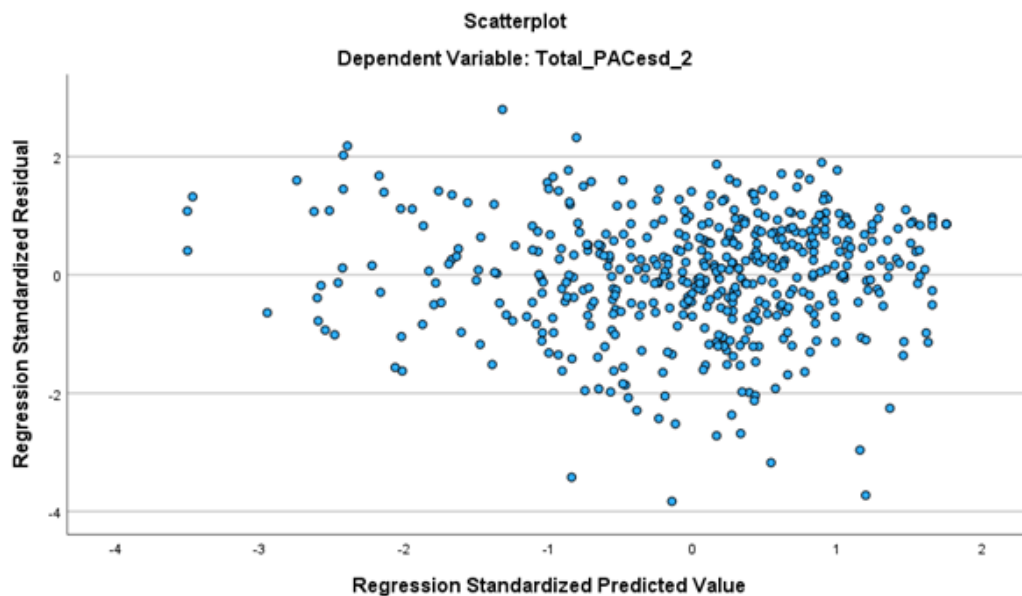


Figure 4.2. Scatterplot for PACesd.

From Figure 4.3 to Figure 4.5, there were a few data points less than -3.3 so, no data was removed. The maximum values for Cook's Distance were .128 for primary, 0.451 for middle and 0.436 for high school which indicated there were no significant problems with outliers.

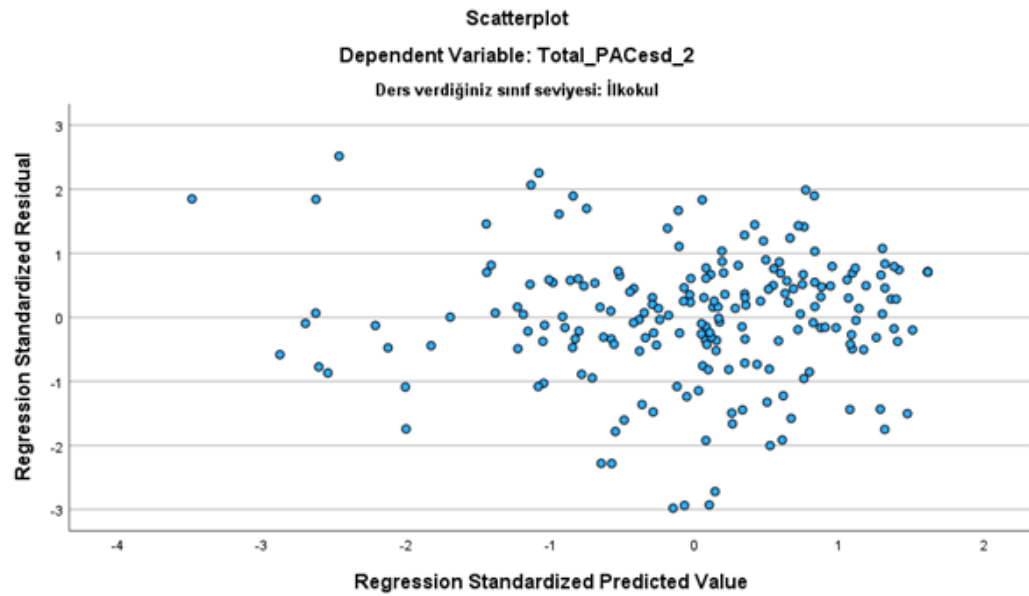


Figure 4.3. Scatterplot for PACesd for primary school.

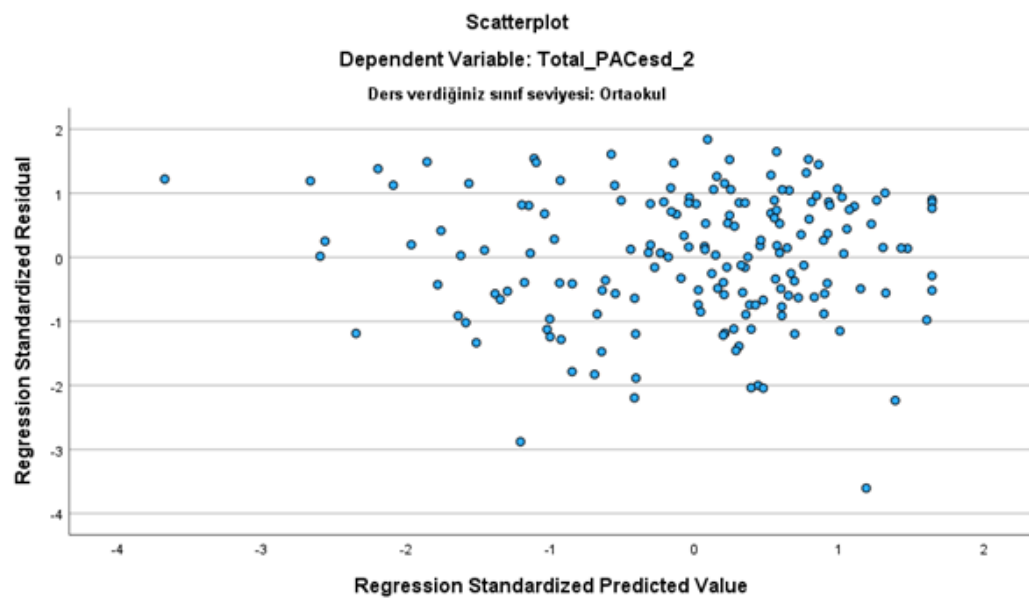


Figure 4.4. Scatterplot for PACesd for middle school.

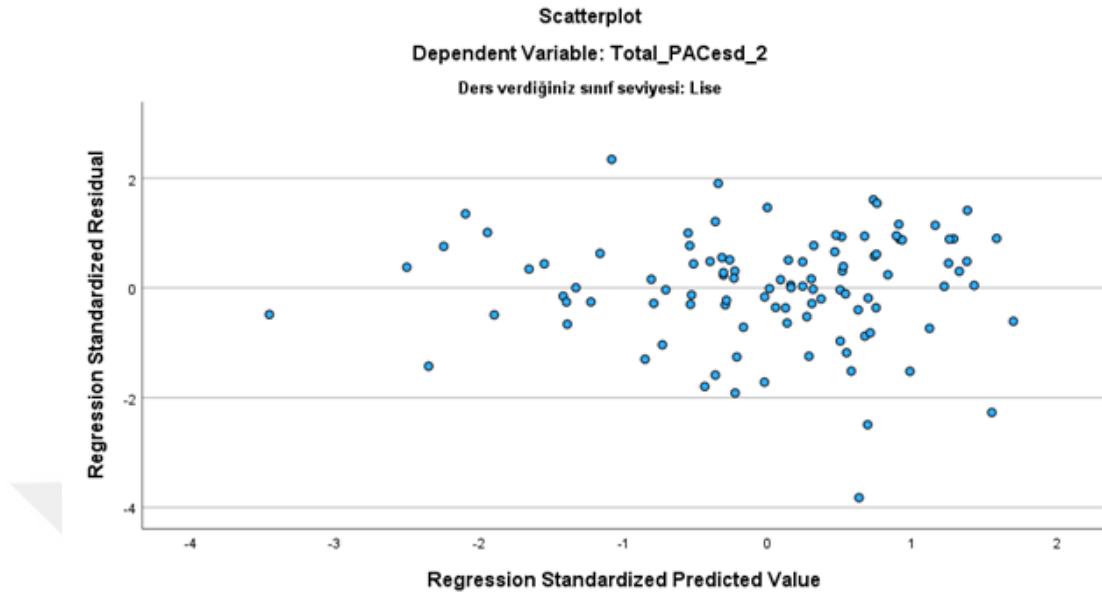


Figure 4.5. Scatterplot for PACesd for high school.

Normality: All variables' scores should be normally distributed to meet this assumption. One of the ways to investigate whether this assumption is met is checking the skewness and kurtosis values. A kurtosis value between ± 1.0 is considered excellent, while between ± 2.0 is acceptable and similarly, for skewness, a value within ± 1.0 is excellent, while between ± 2.0 is acceptable as proposed by George and Mallery (2019). In this study, the skewness and kurtosis values were in this range as shown in the Table 4.18 indicating normal distribution for all variables.

Table 4.18. Skewness and Kurtosis values for dependent variable and independent variables.

Variable	Skewness	Kurtosis
Professional Action Competence in ESD	-0.362	-0.313
ESD Value	-0.590	-0.481
Sustainability Teaching Outcome Expectancy	-0.419	0.128
Teacher Self-Regulation	-1.105	1.040

Also, as seen from Figure 4.6 to Figure 4.9, data points form a relatively straight diagonal line. This indicates no significant deviations from normality.

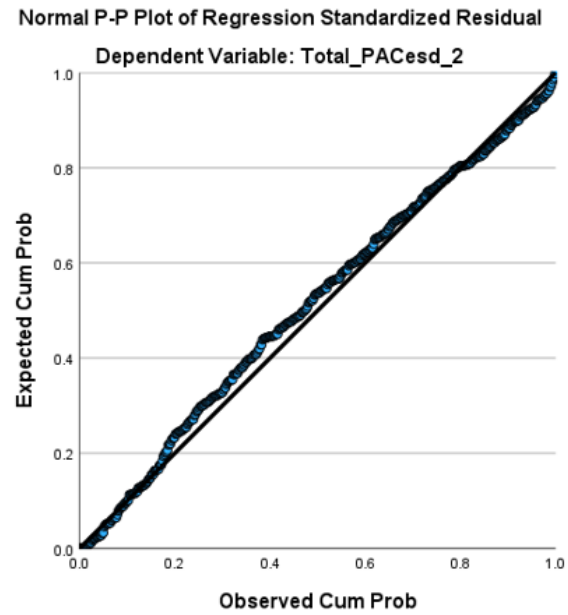


Figure 4.6. Normal P-P plot of regression standardized residual.

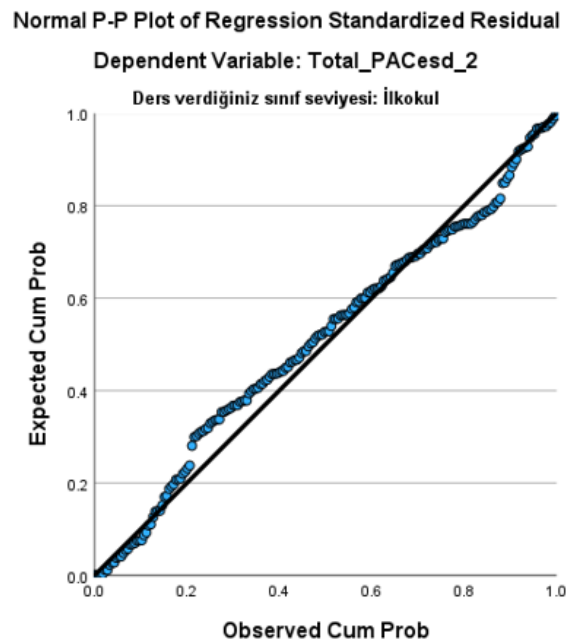


Figure 4.7. Normal P-P plot of regression standardized residual (primary school).

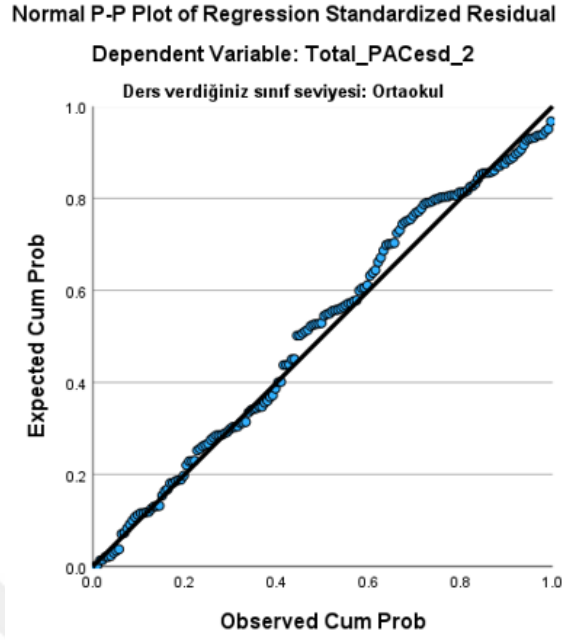


Figure 4.8. Normal P-P plot of regression standardized residual (middle school).

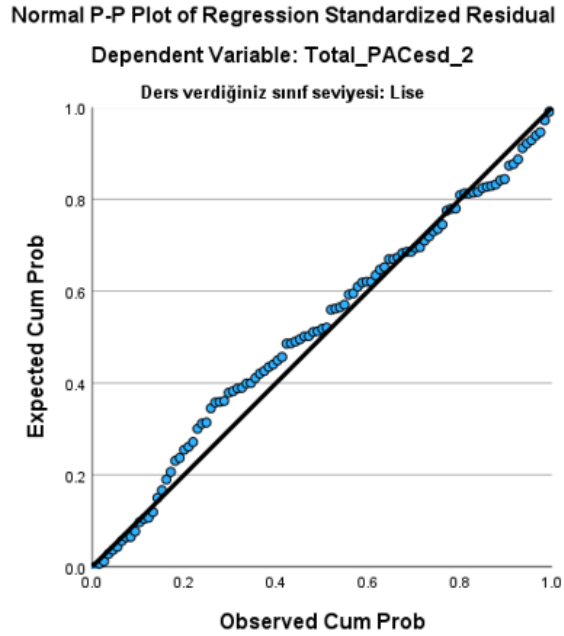


Figure 4.9. Normal P-P plot of regression standardized residual (high school).

Linearity: Linearity assumption was met as Figure 4.10, Figure 4.11 and Figure 4.12 indicate.

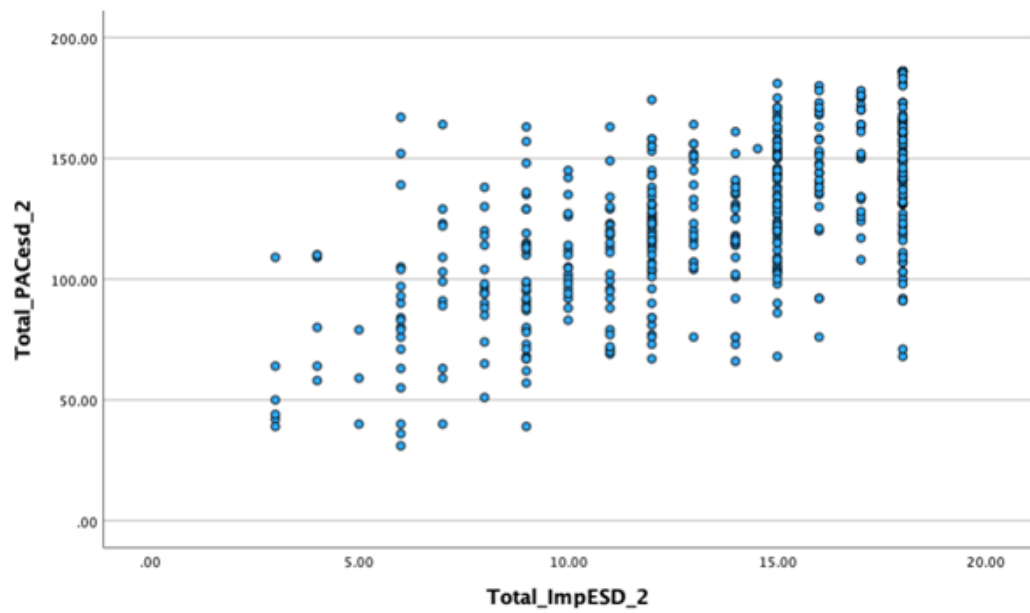


Figure 4.10. Relation between PACesd and ESD value.

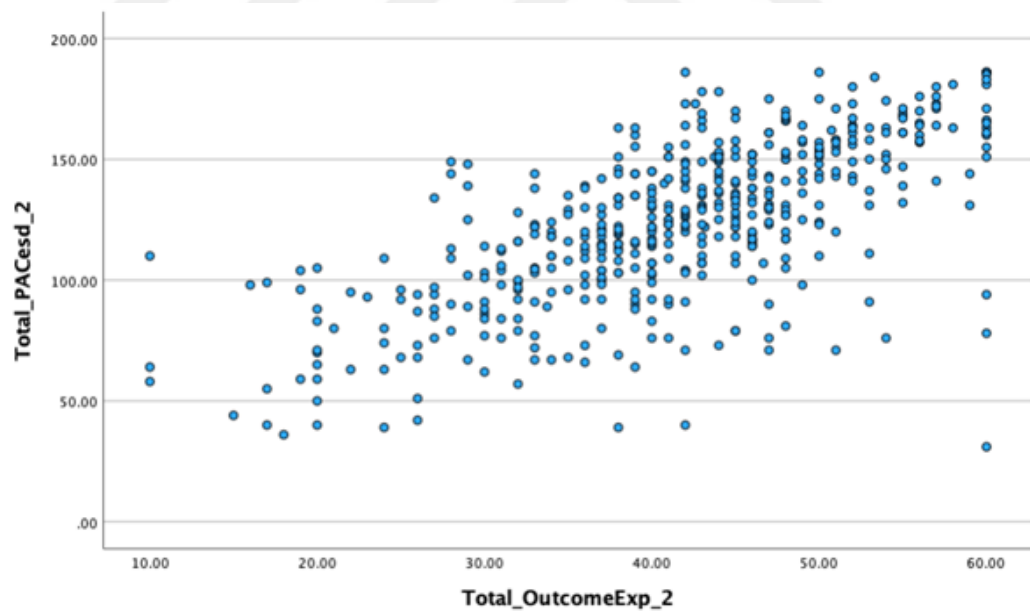


Figure 4.11. Relation between PACesd and Sustainability Teaching Outcome Expectancy.

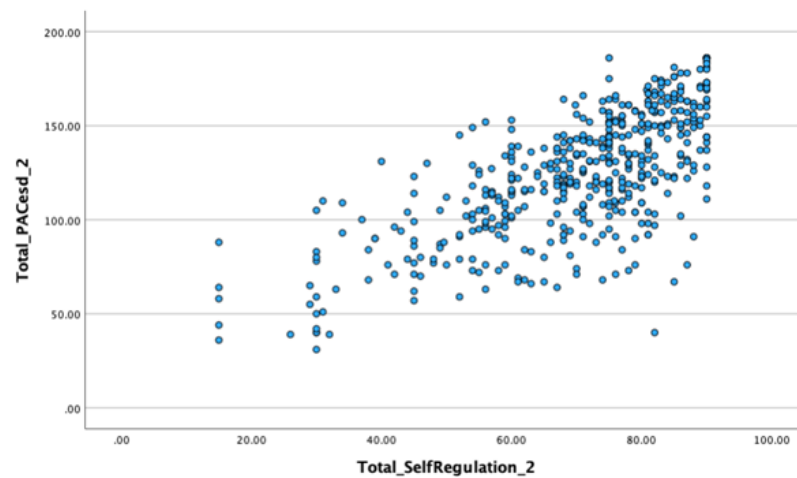


Figure 4.12. Relation between PACesd and teacher self-regulation.

Homoscedasticity: This assumption is associated with spread of residuals about dependent variable being consistent across the range of predicted values (Pallant, 2016). From Figure 4.2 to Figure 4.5, it can be observed that the shape of the data is rectangular. In addition, most data points are at the zero line. Thus, this assumption is not violated.

Independence of errors: In regression, it's typically assumed that the predicted value is unrelated to other predictions, in other words, each predicted value is regarded as independent (Ho, 2013). This assumption was checked by Durbin-Watson statistics. As seen in Table 4.19, presented under the section 4.5.2, and Table 4.22, presented under the section 4.5.3, the values were found to fall within the range of $1.5 < d < 2.5$. Therefore, this assumption was not violated.

4.5.2. Results of Hierarchical Multiple Regression Analysis

A hierarchical multiple regression analysis was conducted to demonstrate how independent variables that are ESD value, sustainability teaching outcome expectancy and teacher self-regulation both collectively and uniquely contributed to predicting professional action competence in ESD while controlling for education level. Here, the independent variables (IVs) were entered into the model in a predetermined order.

Because the education level in which teachers teach (primary, middle and high school) was controlled for, the dummy variables for education level were entered in Block 1. Then, all the IVs were entered in Block 2. As seen in the Table 4.14, presented under the section 4.5.1, the results of the Pearson correlation showed that there were statistically significant positive relationships among all the study variables ($p < 0.05$).

Because one-way between-groups ANOVA analysis showed that there was a statistically significant difference between primary school and high school in-service teachers in terms of their PACesd scores and between middle school and high school in-service teachers in terms of their PACesd scores, this variable was included as a control in hierarchical multiple regression analysis. According to the Table 4.19, after the variables in Block 1 (being primary school teacher, being middle school teacher) have been entered as dummy variables, the overall model explained 2.1 percent of the variance. After additional block 2 variables (teacher self-regulation, sustainability teaching outcome expectancy and ESD value) have also been included, the model as a whole explained 59.5 percent.

As Cohen and Cohen (1983) suggests, R-squared values higher than 0.25 indicates a large effect size. This study's R-squared value for model 2 was 0.595 showing a large effect size. Teacher self-regulation, sustainability teaching outcome expectancy and ESD value explained an additional 57.4 percent of the variance in PACesd, even when the effect of education level in which in-service teachers teach was statistically controlled for ($R^2 \text{ change} = .574$, $F \text{ change} (3, 469) = 221.60$, $p < 0.05$).

Table 4.21 illustrates regression coefficients and significance values. Here, the beta (β) weights show the extent to which each IV contributed to the DV after controlling for other predictors. When analyzing effect sizes, standardized regression coefficients below .10 were considered small, coefficients around .30 were regarded as medium, and coefficients higher than 0.50 were deemed large effect size (Kline, 1998). Looking at the p values for Model 1 that had the control variables, both variables made a unique statistically significant contribution to predicting PACesd. Being primary school teacher made a unique statistically significant contribution with the 0.188 beta value ($p < 0.05$) and being middle school teacher also made a unique statistically significant contribution with the 0.139 beta value ($p < 0.05$). Both of them have small effect sizes. Also, looking at the p value for Model 2 that had all the variables, ESD value ($\beta = 0.181$, $p < 0.05$), sustainability teaching outcome expectancy ($\beta = 0.324$, $p < 0.05$), teacher self-regulation ($\beta = 0.361$, $p < 0.05$), and being a primary school teacher ($\beta = .094$, $p < 0.05$) made unique statistically significant contributions to predicting PACesd while being a middle school teacher ($\beta = 0.055$, $p > 0.05$) did not. Thus, teacher self-regulation and sustainability teaching outcome expectancy have medium effect sizes while ESD value has small effect size.

Table 4.21. Regression coefficients for predicting PACesd.

		Unstandardized		Standardized				
		Coefficients		Coefficients				
Model	Variable	B	SE	β	t	p	95% CI	
							Lower Bound	Upper Bound
1	Being Primary School Teacher	12.4	3.9	0.188	3.17	0.002*	4.733	20.16
	Being Middle School Teacher	9.5	4.0	0.139	2.34	0.019*	1.535	17.45
	Constant	115.1	3.2		36.0	<0.001*	108.8	121.4

Table 4.21 Regression coefficients for predicting PACesd. (cont.)

Model	Variable	Unstandardized		Standardized	t	p		
		Coefficients		Coefficients			95% CI	
		B	SE	β			Lower Bound	Upper Bound
2	Being Primary School Teacher	6.2	2.5	0.094	2.43	0.016*	1.181	11.19
	Being Middle School Teacher	3.7	2.6	0.055	1.43	0.155	-1.418	8.893
	ESD Value	1.5	0.35	0.181	4.40	<0.001*	0.843	2.201
	Sustainability Teaching Outcome Expectancy	1.1	0.13	0.324	7.92	<0.001*	0.796	1.321
	Teacher Self-Regulation	0.75	0.09	.361	8.28	<0.001*	0.569	0.923
	Constant	3.9	4.8		0.801	0.424	-5.621	13.35

Note. Dependent Variable: Professional Action Competence in ESD. *p<0.05.

4.5.3. Results of Standard Multiple Regression Analysis

A standard multiple regression analysis was conducted to demonstrate how much variance in PACesd was explained by ESD value, sustainability teaching outcome expectancy and teacher self-regulation for each education level. This analysis also indicated the amount of unique contribution to predicting PACesd by independent factors. The three independent variables (predictors) were entered into the model simultaneously. This analysis was done for each education level as it would have been thought to be useful to see the results for each education level separately. As Table 4.15 illustrates, presented under the section 4.5.1, the results of the Pearson correlation indicated that there were statistically significant positive relationships between all the study variables for each education level ($p < 0.05$).

Because there were statistically significant differences among in-service teachers teaching at different levels of education (i.e., primary, middle, high school) in their PACesd, the regression analysis was performed for each education level in order to see thoroughly how results were changing according to that criterion. Based on Table 4.22, the model as a whole including the variables ESD value, sustainability teaching outcome expectancy and teacher self-regulation explained 70% variance in PACesd for primary school in-service teachers, 58% variance in PACesd for middle school in-service teachers and 38.1% variance in PACesd for high school in-service teachers. All of these indicated large effect size (Cohen and Cohen, 1983).

Table 4.22. Model Summary.

Education Level	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics				Durbin-Watson
							F Change	df1	df2	Sig F. Change	
Primary School	1	0.836a	0.700	0.695	18.54967	0.700	153.7	3	198	< 0.001*	1.995
Middle School	1	0.761a	0.580	0.572	21.83643	0.580	76.3	3	166	<0.001*	1.944
High School	1	0.618a	0.381	0.363	22.52652	0.381	20.4	3	99	<0.001*	1.967
a. Predictors: (Constant), Sustainability Teaching Outcome Expectancy, Teacher Self-Regulation, ESD Value											
b. Dependent Variable: Professional Action Competence in ESD											
*p<0.05.											

Moreover, the ANOVA table shows that the model was significant for primary school teachers ($F(3, 198) = 153.7, p < 0.05$), for middle school teachers ($F(3, 166) = 76.3, p < 0.05$), for high school teachers ($F(3, 99) = 20.4, p < 0.05$).

Table 4.23. ANOVA^a.

Education Level	Model		<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Primary School	1	Regression	158685.6	3	52895.2	153.7	<0.001b*
		Residual	68129.9	198	344.09		
		Total	226815.4	201			
Middle School	1	Regression	109091.0	3	36263.7	76.26	<0.001b*
		Residual	79153.8	166	476.8		
		Total	188244.7	169			
High School	1	Regression	30985.4	3	10328.5	20.35	<0.001b*
		Residual	50237.0	99	507.4		
		Total	81222.4	102			
a. Dependent Variable: Professional Action Competence in ESD b. Predictors: (Constant), Sustainability Teaching Outcome Expectancy, Teacher Self-Regulation, ESD Value *p<0.05.							

Table 4.24 illustrates regression coefficients and significance values. Looking at the p value of the model for primary school teachers that had all the variables, ESD value ($\beta = 0.242$, $p < 0.05$), sustainability teaching outcome expectancy ($\beta = 0.402$, $p < 0.05$), teacher self-regulation ($\beta = 0.284$, $p < 0.05$) made unique statistically significant contributions to the prediction of PACesd. Here, sustainability teaching outcome

expectancy has medium to large effect size and made the strongest unique contribution to explaining the DV. Teacher self-regulation and ESD value have small to medium effect sizes and made less of a unique contribution. The model for middle school teachers indicated that, ESD value ($\beta = 0.204$, $p < 0.05$), sustainability teaching outcome expectancy ($\beta = 0.277$, $p < 0.05$), teacher self-regulation ($\beta = 0.411$, $p < 0.05$) made unique statistically significant contributions to predicting PACesd. In this, teacher self-regulation has medium to large effect size and made the strongest unique contribution to explaining the DV while the other two made less with small to medium effect sizes. The model for high school teachers indicated that sustainability teaching outcome expectancy ($\beta = 0.242$, $p < 0.05$), teacher self-regulation ($\beta = .398$, $p < 0.05$) made unique statistically significant contributions to predicting PACesd while ESD value ($\beta = 0.047$, $p > 0.05$) did not. Here, teacher self-regulation made the strongest unique contribution to explaining the DV with medium to large effect size. Sustainability teaching outcome expectancy has small to medium effect size while ESD value has very small.

Table 4.24. Regression Coefficients For Predicting PACesd.

Education Level	Model	Variable	Unstandardized		Standardized	t	p		
			Coefficients		Coefficients				
			B	SE	β			95% CI	
								Lower Bound	Upper Bound
Primary School	1								
		ESD Value	2.2	0.53	0.242	4.15	<0.001*	1.147	3.227
		Sustainability Teaching Outcome Expectancy	1.3	0.20	0.402	6.49	<0.001*	0.918	1.720

Table 4.24 Regression Coefficients For Predicting PACesd. (cont.)

Education Level	Model	Variable	Unstan- dardized		Stan dardized	t	p	95% <i>CI</i>	
			Coeffi- cients		Coeffi- cients				
			B	SE	β			<i>Lower Bound</i>	<i>Upper Bound</i>
		Teacher Self- Regulation	0.60	0.13	0.284	4.57	<0.001*	0.337	0.847
		Constant	1.05	6.13		.17	.865	-11.050	13.143
Middle School	1								
		ESD Value	1.7	0.57	0.204	3.04	0.003*	0.603	2.835
		Sustainability Teaching Outcome Expectancy	0.93	0.21	0.277	4.33	<0.001*	0.503	1.345
		Teacher Self- Regulation	0.86	0.14	0.411	6.06	<0.001*	0.582	1.144
		Constant	2.25	8.35		0.27	0.788	-14.236	18.733
High School	1								
		ESD Value	0.33	0.76	0.047	0.43	0.669	-1.117	1.827
		Sustainability Teaching Outcome Expectancy	0.72	0.31	0.242	2.31	0.023*	0.103	1.340
		Teacher Self- Regulation	0.75	0.23	0.398	3.24	0.002*	0.291	1.213
		Constant	31.9	11.0		2.90	0.005*	10.093	53.615

Note. Dependent Variable: Professional Action Competence in ESD. *p<0.05.

5. DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

There is a need to transform societies towards sustainable development which requires sustainability change-makers to make this happen. Therefore, learners should be equipped with necessary knowledge, skills, attitudes and values to actively participate in sustainability issues. In that regard, ESD has the potential to promote learners to take responsible action and find democratic solutions towards sustainability issues to move the society they live in towards sustainability (Mogensen and Schnack, 2010; Rieckmann, 2017). However, it is pointed out that ESD is not an easy educational approach for teachers to integrate into their curricula (Sass, 2022). Additionally, the educational policy focusing on sustainable development places teachers and educators across all educational levels as central to implementing ESD (Isac *et al.*, 2022). Therefore, in this study, teachers' competence in ESD were investigated using the professional action competence in ESD (PACesd) scale recently developed by Sass *et al.* (2022). 302 in-service teachers participated in the first stage of the study which is the adaptation of PACesd into Turkish. PACesd framework made it possible to include in-service teachers whose importance has been highlighted in literature (Popova *et al.*, 2016; Sass *et al.*, 2022). Also, this framework enabled to include teachers from primary, middle and high schools to study. This was important to investigate as education levels can set disciplinary boundaries in the implementation of ESD (Borg *et al.*, 2012; Isac *et al.*, 2022; Taylor *et al.*, 2019). 475 in-service teachers participated in the second stage of the study. At this stage of the research, differences among in-service teachers in terms of their PACesd scores were investigated based on the educational level they are teaching at, their subject area, teaching experience and gender. Besides these, the relation of sustainability teaching outcome expectancy, ESD value and teacher-self regulation to PACesd was examined as well in two ways. Initially, the study analyzed the relation of these variables to PACesd, taking into account education level in which in-service teachers teach as a control. Subsequently, the relationship of them to PACesd was explored separately for each education level, without controlling for any variables.

5.1. Discussion of the Results

5.1.1. Adaptation of PACesd Scale

Confirmatory factor analysis (CFA) was conducted for the validity analysis of PACesd scale. Multiple fit indices that are Comparative Fit Index (CFI), Tucker–Lewis index (TLI) and Root Mean Square Error of Approximation (RMSEA) were used to assess the goodness of the fit. These indices were found to fall within the acceptable range of values (Hu and Bentler, 1999; Marsh *et al.*, 2013). All the factor loadings exceeded the critical limit (Pituch and Stevens, 2016) and all the items were significantly loaded onto the hypothesized factors. Also, factor structure of the Turkish version of the PACesd scale was found to have three factors as in the original scale. In terms of reliability, PACesd scale and its sub-constructs were found to have excellent internal consistency (Cicchetti, 1994). In conclusion, the data collected in this study supported the validity and reliability of the Turkish version of PACesd scale.

Besides the PACesd scale, IMPesd scale was also adapted into Turkish to measure ESD value. CFA was carried out for the validity analysis of IMPesd. Multiplied fit indices showed an excellent fit (Hu and Bentler, 1999; Marsh *et al.*, 2013). All the factor loadings were higher than the critical limit (Pituch and Stevens, 2016) and correlations between items and the factor were significant. For reliability analysis, it was found that this scale has excellent internal consistency (Cicchetti, 1994). In conclusion, the data collected in this study supported the validity and reliability of the Turkish version of IMPesd scale.

5.1.2. Differences among In-Service Teachers Teaching at Different Levels of education (i.e. primary, middle and high school) in terms of Their PACesd Scores

In this study, professional action competence in ESD was investigated across three levels of education that are primary, middle and high school. It was found that

there were statistically significant differences among in-service teachers from these three education levels in terms of their PACesd scores with the small to medium effect size (Cohen, 1988). The highest mean score belonged to primary school teachers which is consistent with the findings of Isac *et al.* (2022). Also, this was expected as research emphasized that integrating ESD may pose greater challenges in secondary school settings as some difficulties such as disciplinary boundaries in such schools makes it more challenging for secondary school teachers to integrate ESD compared to teachers in primary education and how these challenges influence their perceived competence regarding the implementation of ESD (Borg *et al.*, 2012; Isac *et al.*, 2022; Taylor *et al.*, 2019). The lowest score belonged to high school teachers. Primary school teachers' scores were statistically significantly higher than high school teachers. Also, middle school teachers' scores were statistically significantly higher than high school teachers. There were no statistically significant differences between primary and middle school in-service teachers in terms of their PACesd scores.

5.1.3. Differences among In-service Teachers from Different Disciplines in terms of Their PACesd Scores

It is recommended to investigate teachers' PACesd based on their subject areas (Isac *et al.*, 2022). It was found that there were no statistically significant differences across all disciplines in terms of their PACesd scores. Also, the highest mean score belonged to primary school in-service teachers which is consistent with the literature (e.g. Borg *et al.*, 2012; Isac *et al.*, 2022). When the mean scores were compared, high school teachers often had lower mean scores. The lower mean scores of high school teachers compared to teachers at other educational levels may suggest that high school teachers have different priorities, particularly in the context of Türkiye. After primary school, lessons are increasingly designed to prepare students for high school or university exams. This focus intensifies particularly in high school, potentially affecting mean scores of high school teachers. So, high school students are primarily focused on preparing for the university entrance exam, which shifts the focus of high school teachers towards ensuring their students' success in this exam. Consequently, this

emphasis makes it more challenging for high school teachers to develop competences in educational approaches such as ESD, which is not directly tied to university exam success.

5.1.4. Differences among In-service Teachers in terms of Their PACesd Scores based on Their Teaching Experience and Gender

Two other variables that are teaching experience and gender were investigated in case of a significant result. There were no statistically significant differences among teachers having different years of teaching experience in terms of their PACesd scores. Teachers having 11-15 years of teaching experience reported highest PACesd while teachers having 1-5 years of teaching experience had the lowest PACesd. Also, there was no significant difference between males and females in terms of their PACesd scores. Males reported slightly higher PACesd scores. These two variables were not used as control variables during multiple regression analyses as the results were not significant.

5.1.5. The relation of Sustainability Teaching Outcome Expectancy, ESD Value and Teacher Self-Regulation to PACesd

Both hierarchical and multiple regression were carried out in this study.

A hierarchical multiple regression analysis was conducted to demonstrate how ESD value, sustainability teaching outcome expectancy and teacher self-regulation contributed to predicting PACesd while controlling for the influence of education level in which in-service teachers teach. Firstly, it was found that there were statistically significant positive relationships among PACesd, ESD value, sustainability teaching outcome expectancy and teacher self-regulation. In this, there was high correlation between ESD value and PACesd which is similar but slightly having higher correlation than the findings of Sass *et al.* (2022). Since there were statistically significant differences among educational levels in terms of PACesd scores, being at primary school level and at middle school level relative to being at high school level was added to the

model. These dummy variables have explained very little portion of the variance in the model. Therefore, it can be concluded that control variables nearly did not have any effect on explaining the variance in the dependent variable. Combining insights from some studies has greatly helped to determine the factors of ESD value (e.g. Bertschy *et al.*, 2013; Effeney and Davis, 2013; Sass *et al.*, 2022; Vukelić, 2022), sustainability teaching outcome expectancy (e.g. Malandrakis *et al.*, 2019; Sass *et al.*, 2020, 2022), and teacher self-regulation (e.g. Baumert and Kunter, 2013; Bertschy *et al.*, 2013; Sass *et al.*, 2020; Vukelić, 2022) in terms of their ability to predict PACesd. The model including these three study variables were able to explain a large portion of variance in PACesd. Also, it is important to note that linear combination of predictors statistically significantly predicted PACesd. Therefore, it can be said that collective information from the research on the determination of the variables has allowed to make a predictive model. When the unique contributions were compared among the predictors, teacher self-regulation made the highest unique contribution with medium effect size. Sustainability teaching outcome expectancy followed it closely with medium effect size. ESD value made the least unique contribution to the prediction of PACesd with small effect size. Besides this, all of them were able to make statistically significantly unique contributions to predicting PACesd. In terms of dummy variables, both being primary and middle school teacher were able to make statistically significant unique contributions to predicting PACesd with small effect sizes in the absence of three predictors (ESD value, sustainability teaching outcome expectancy and teacher self-regulation). However, when other three variables were included to model, being a primary school teacher still made statistically significant unique contribution while being a middle school teacher was no longer able to do so. In other words, when all variables are controlled, the difference between high school teachers and middle school teachers becomes insignificant. However, the difference between primary school and high school teachers is still significant even after controlling for other variables.

A standard multiple regression analysis was performed to investigate how much variance in PACesd was explained by ESD value, sustainability teaching outcome expectancy and teacher self-regulation for each education level (i.e. primary, middle and

high school). Firstly, there were statistically significant positive relationships between all the study variables for each education level. In this, there was high correlation between ESD value and PACesd which is similar but again slightly having higher correlation than the findings of Sass *et al.* (2022) except for high school. The model as a whole containing ESD value, sustainability teaching outcome expectancy and teacher self-regulation explained the highest variance in PACesd for primary school teachers, and it was followed by middle and then high school teachers. According to this, it can be inferred that the chosen predictors predict the best at the primary level. Also, all the models were found to be significant. All the study variables that are ESD value, sustainability teaching outcome expectancy and teacher self-regulation made statistically significantly unique contributions to predicting PACesd in the models for primary school teachers and middle school teachers. However, ESD value did not make any significant unique contribution in the model for high school teachers. This can be attributed to the specific agenda of high school teachers, who may primarily focus on preparing students for the university entrance exam. This emphasis can detract from their ability to recognize the importance of ESD. Furthermore, sustainability teaching outcome expectancy was the variable making the biggest contribution in the model for primary school teachers with medium to large effect size while teacher self-regulation was the one making the highest contribution to predicting PACesd for the models for middle and high school teachers with medium to large effect sizes for each. ESD value was always the one making the least unique contribution for each education level and it did not even meet the small effect size criterion for high school teachers.

5.2. Implications

There are some implications from this research for different groups such as researchers, higher education institutions, teachers and other educators, policy-makers.

Since it was found that ESD value, sustainability teaching outcome expectancy and teacher self-regulation contributed to predicting PACesd while controlling for the effect of education level in which in-service teachers teach, researchers can carry out

experimental studies that aim to the improvement of these variables for the development of PACesd. Also, the improvement of these three variables reduces the difference among teachers as it was inferred that the difference between high school teachers and middle school teachers became insignificant in the model including all variables. However, in that situation, being primary school teacher still made statistically significant unique contribution. Therefore, further investigation is needed to identify variable/s that should be included in the predictive model so that there will be no differences among all education levels in their PACesd. Further investigation on the identification of variables is also particularly necessary for the model constructed in the category of high school since the variance explained in PACesd was relatively low compared to other two levels.

Teacher in-training should incorporate ESD, aiming to raise awareness among teachers regarding its importance and implementation, and enhance their competences in this area within a collaborative setting. This collaborative environment should not only involve teachers within the same disciplines but also encourage interdisciplinary cooperation. The models including ESD value, sustainability teaching outcome expectancy and teacher self-regulation were all able to explain notable variance in PACesd. Therefore, these variables should be taken into account collectively while preparing training modules. In addition, during the professional accreditation process for teachers and other educators, their qualifications should be evaluated with regard to the ESD competences as well.

Higher education institutions play an important role in shaping the educational environment of the future with their teacher education programs. The results of this study suggest a necessity to advocate for the integration of ESD within faculties of education, particularly within programs that prepare teachers for middle and high school levels, with clearly defined objectives articulated both theoretically and practically. While doing so, the emphasis should be on the inclusion of the study variables sustainability teaching outcome expectancy, ESD value and teacher self-regulation for the improvement of ESD competences of teachers. Therefore, educators in higher education

should have and be aware of such competences and aim to enhance these competences of teachers. Also, teacher education programs should establish connections at regional, national, and international levels to cultivate and apply ESD competences through collaboration with experts across various fields.

The Turkish National Curriculum should integrate ESD across all subjects, including mathematics, in a holistic, pluralistic, and action-oriented manner. Additionally, it should be structured to facilitate interdisciplinary work.

5.3. Limitations and Recommendations

One of the limitations of this study is related to the sample of the study. As some of the disciplines' current curricula such as mathematics (MoNE, 2018) did not include sustainability and some of the items in the scales are related to the implementation of ESD in the school context in line with the curriculum, teachers from some disciplines such as mathematics teachers in middle and high schools could not be included. Another limitation is that while evaluating the variables of the study, self-reports of the teachers were considered, which could be influenced by social desirability biases. Therefore, additional studies that involve qualitative research techniques such as observation of the implementation of ESD and interviews with teachers can offer a deeper understanding of teacher competences. This can offer valuable insight of the specific sequence of disciplinary areas of teachers and the educational levels they teach in terms of their PACesd. For example, high school teachers can be interviewed on the difficulties they face while implementing ESD to complement the quantitative data. For the disciplinary areas of teachers, the numbers were not very proportional. Therefore, investigation on competences can be done with each discipline containing equal or proportionally close numbers to get more representative results. Lastly, PACesd's sub constructs that are self-efficacy, perceived PCK and willingness regarding the implementation of ESD can be examined separately.

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APPENDIX A: DEMOGRAPHIC FORM

This is the demographic form used in the study

Cinsiyet	☐ Kadın ☐ Erkek	
Okul Seviyesi ve Türü	☐ İlkokul ☐ Ortaokul ☐ Lise	☐ Özel ☐ Devlet
Branş		
Öğretmenlik Deneyimi (gün/ay/yıl)		

Figure A.1. Demografik form.

**APPENDIX B: PROFESSIONAL ACTION
COMPETENCE IN EDUCATION FOR SUSTAINABLE
DEVELOPMENT (PACESD) SCALE / SÜRDÜRÜLEBİLİR
KALKINMA EĞİTİMİNDE (SKE) MESLEKİ EYLEM
YETERLİLİĞİ ÖLÇEĞİ**

This is the PACesd Scale adapted to Turkish.

Sevgili öğretmenler, bu anket sizin Sürdürülebilir Kalkınma Eğitiminde Mesleki Eylem Yeterliliğiniz hakkındadır. Ölçeğin maddelerini dikkatle okuyun ve maddelere dair düşüncelerinizi en iyi tanımlayan seçeneği (X) işaretini koyarak ifade ediniz. Ölçekteki her bir ifade için 6 seçenek yer almaktadır ve seçenekler “1: Kesinlikle Katılmıyorum” ile “6: Kesinlikle Katılıyorum” şeklindedir. Tüm ifadeleri mutlaka cevaplamanız gerekmektedir. İfadelerin doğru ya da yanlış cevapları yoktur. Lütfen ölçeği içten ve samimi olarak cevaplayınız. Cevaplarınız gizli tutulacak ve hiçbir kimseyle paylaşılmayacaktır.

Katkılarınızdan dolayı teşekkür ederiz.

Bir öğretmen olarak,

	1	2	3	4	5	6
öğrencilerin bir soruna farklı bakış açılarından bakabilme becerilerini geliştirebildiğime eminim.						
öğrencilerin sürdürülebilirlik ile ilgili konulara yönelik farklı çözümleri değerlendirme becerilerini geliştirebildiğime eminim.						
öğrencilerin kendi eylemleri üzerine düşünme becerilerini geliştirebildiğime eminim.						
öğrencilerin sürdürülebilirlik konularında kendi görüşlerini ifade etme becerilerini geliştirebildiğime eminim.						
öğrencilerin sürdürülebilir kalkınmanın sosyal, çevresel ve ekonomik boyutları arasındaki karşılıklı bağlantıyı anlama becerilerini geliştirebildiğime eminim.						
öğrencilerin sürdürülebilir kalkınmaya giden yolda çıkar çatışmaları olduğunu fark etmelerini sağlayabildiğime eminim.						
öğrencilerin sürdürülebilir kalkınmaya giden yolun yüksek düzeyde belirsizlik içerdiğini fark etmelerini sağlayabildiğime eminim.						
öğrencilerin yerel düzeyde (örneğin okulda) sürdürülebilir kalkınma için harekete geçme becerilerini geliştirebildiğime eminim.						
öğrencilerin bölgesel düzeyde (örneğin şehir) sürdürülebilir kalkınma için harekete geçme becerilerini geliştirebildiğime eminim.						
öğrencilerin sürdürülebilir kalkınma için küresel olarak hareket etme (örneğin belirli ürünleri boykot etme) becerilerini geliştirebildiğime eminim.						
Sürdürülebilir Kalkınma Eğitimini sınıf(lar)ımda uygulayabildiğime eminim.						
Sürdürülebilir Kalkınma Eğitimini okulumda uygulayabildiğime eminim.						
uyguladığım/uyguladığınız bir SKE projesini değerlendirebildiğime eminim.						
öğretimimde sürdürülebilirlik konularının çevresel boyutlarını ele alabildiğime eminim.						
öğretimimde sürdürülebilirlik konularının sosyal boyutlarını ele alabildiğime eminim.						
öğretimimde sürdürülebilirlik konularının sosyo-ekonomik boyutlarını ele alabildiğime eminim.						
öğretimimde sürdürülebilirlik konularının küresel boyutlarını ele alabildiğime eminim.						
kazanımlar doğrultusunda sürdürülebilir kalkınma üzerine çalışabildiğime eminim.						
sürdürülebilir kalkınma konusunda disiplinler arası çalışabildiğime eminim.						
öğrencilerim için müfredatta yer alan kazanımlar doğrultusunda sürdürülebilir kalkınmaya ilişkin ek kazanımlar oluşturabildiğime eminim.						
sürdürülebilirlik konularında çalışmak üzere öğrenme ortamları tasarlama esnekliğine sahip olabildiğime eminim.						

Figure B.1. Sürdürülebilir kalkınma eğitiminde (SKE) mesleki eylem yeterliliği ölçeği.

Lütfen aşağıdaki ifadelere katılma düzeyinizi belirtiniz...	1	2	3	4	5	6
Her gün, Sürdürülebilir Kalkınma Eğitimi (SKE) üzerine çalışmak için yeterli fırsatı oluşturduğuma emin olurum.						
SKE genel anlamda beni yansıtır.						
SKE benim için değerlidir. SKE olmadan ben kendim olamazdım.						
SKE uygulamak bana enerji verir.						
Günlük işlerimi, SKE'ye mümkün olduğunca fazla zaman ayıracak şekilde planlamaya çalışırım.						
SKE üzerine çalışırken bunu güçlü bir deneyim olarak yaşarım.						
SKE hayatımda önemli bir rol oynayacak.						
SKE üzerine çalışmak için sık sık güçlü bir dürtü hissedirim.						
Genelde, SKE üzerine çalışmayı gerçekten dört gözle beklerim.						
Kişisel hedeflerimin çoğu SKE ile ilgilidir.						

Figure B.2. Sürdürülebilir kalkınma eğitiminde (SKE) mesleki eylem yeterliliği ölçeği.

APPENDIX C: PERCEIVED IMPORTANCE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT (IMPESD) SCALE / SÜRDÜRÜLEBİLİR KALKINMA EĞİTİMİNİN ALGILANAN ÖNEMİ ÖLÇEĞİ

This is the IMPesd Scale adapted to Turkish.

Sevgili öğretmenler, bu anket sizin Sürdürülebilir Kalkınma Eğitiminin Algılanan Önemi ile ilgili düşüncelerinizi belirlemeyi amaçlamaktadır. Anketin maddelerini dikkatle okuyun ve maddelere dair düşüncelerinizi en iyi tanımlayan seçeneği (X) işaretini koyarak ifade ediniz. Ölçekteki her bir ifade için 6 seçenek yer almaktadır ve seçenekler “1: Kesinlikle Katılmıyorum” ile “6: Kesinlikle Katılıyorum” şeklindedir. Tüm ifadeleri mutlaka cevaplamanız gerekmektedir. İfadelerin doğru ya da yanlış cevapları yoktur. Lütfen ölçeği içten ve samimi olarak cevaplayınız. Cevaplarınız gizli tutulacak ve hiçbir kimseyle paylaşılmayacaktır.

Katkılarınızdan dolayı teşekkür ederiz.

Bu sorularla, SKE bağlamında öğretmenlerin görevinin ne olabileceği ya da olmayabileceği konusundaki anlayışınızı ölçmek istiyoruz.						
	1	2	3	4	5	6
1. Öğrencilere sürdürülebilir kalkınma konusunda eğitim vermek öğretmenlerin temel görevidir.						
2. Bir öğretmen olarak sürdürülebilir Kalkınma Eğitimi görevini üstlenmeye hazırım.						
3. Bir öğretmen olarak sürdürülebilir Kalkınma Eğitiminde bir rol oynamam gerektiğine inanırım.						

Figure C.1. Sürdürülebilir kalkınma eğitiminin algılanan önemi ölçeği.

APPENDIX D: SUSTAINABILITY TEACHING OUTCOME EXPECTANCY SCALE / SÜRDÜRÜLEBİLİRLİK ÖĞRETİMİ SONUÇ BEKLENTİSİ ÖLÇEĞİ

This is the sustainability teaching outcome expectancy scale used in the study.

Sevgili öğretmenler, bu ölçek sizin Sürdürülebilirlik Öğretimi Sonuç Beklentisi ile ilgili düşüncelerinizi belirlemeyi amaçlamaktadır. Anketin maddelerini dikkatle okuyun ve maddelere dair düşüncelerinizi en iyi tanımlayan seçeneği (X) işaretini koyarak ifade ediniz. Ölçekteki her bir ifade için 6 seçenek yer almaktadır ve seçenekler “1: Kesinlikle Katılmıyorum” ile “6: Kesinlikle Katılıyorum” şeklindedir. Tüm ifadeleri mutlaka cevaplamanız gerekmektedir. İfadelerin doğru ya da yanlış cevapları yoktur. Lütfen ölçeği içten ve samimi olarak cevaplayınız. Cevaplarınız gizli tutulacak ve hiçbir kimseyle paylaşılmayacaktır.

Katkılarınızdan dolayı teşekkür ederiz.

	1	2	3	4	5	6
1. Eğer bir öğrenci sürdürülebilirlik konularında her zamankinden daha iyi ise, bunun nedeni çoğunlukla öğretmenin daha fazla çaba harcamasıdır.						
2. Öğrencilerin sürdürülebilirlik konularıyla ilgili notlarının iyiye gitmesi genellikle öğretmenin daha etkili bir öğretim yöntemi kullanmasının sonucudur.						
3. Öğrencilerin sürdürülebilirlik konularında başarısız olmasının nedeni büyük bir olasılıkla etkili olmayan sürdürülebilir kalkınma öğretimidir.						
4. İyi bir öğretimle, öğrencilerin sürdürülebilirlik konularındaki bilgi yetersizliklerinin üstesinden gelinebilir.						
5. Öğrencilerin sürdürülebilirlik konularında başarısının düşük olmasından öğretmen sorumlu tutulamaz.						
6. Sürdürülebilirlik konularında başarısız olan bir öğrencinin başarısının artması genellikle öğretmenin daha fazla ilgi göstermesinin sonucudur.						
7. Sürdürülebilirlik konularını öğretirken öğretmenin daha fazla çaba harcaması, bazı öğrencilerin başarısını çok az oranda değiştirir.						
8. Öğrencilerin sürdürülebilirlik konularındaki başarısından genellikle öğretmen sorumludur.						
9. Öğrencinin sürdürülebilirlik konularındaki başarısı, öğretmenin etkili sürdürülebilir kalkınma eğitimi ile doğrudan ilgilidir.						
10. Bir veli çocuğunun sürdürülebilirlik konularına daha fazla ilgi duyduğunu belirtiyorsa, bunun nedeni büyük olasılıkla öğretmenin dersteki performansıdır.						

Figure D.1. Sürdürülebilirlik öğretimi sonuç beklentisi ölçeği.

APPENDIX E: TEACHER SELF-REGULATION SCALE / ÖĞRETMEN ÖZ-DÜZENLEME ÖLÇEĞİ

This is the self-regulation scale used in the study.

Sevgili öğretmenler, bu ölçek öz düzenleme ile ilgili düşüncelerinizi belirlemeyi amaçlamaktadır. Ölçeğin maddelerini dikkatle okuyun ve maddelere dair düşüncelerinizi en iyi tanımlayan seçeneği (X) işaretini koyarak ifade ediniz. Ölçekteki her bir ifade için 6 seçenek yer almaktadır ve seçenekler “1: Kesinlikle Katılmıyorum” ile “6: Kesinlikle Katılıyorum” şeklindedir. Tüm ifadeleri mutlaka cevaplamanız gerekmektedir. İfadelerin doğru ya da yanlış cevapları yoktur. Lütfen ölçeği içten ve samimi olarak cevaplayınız. Cevaplarınız gizli tutulacak ve hiçbir kimseyle paylaşılmayacaktır.

Katkılarınızdan dolayı teşekkür ederiz.

	1	2	3	4	5	6
1. Sürdürülebilir Kalkınma Eğitiminde zamanı etkili kullanma konusunda kendimi yönlendiririm.						
2. Sürdürülebilir Kalkınma Eğitiminde kullandığım yöntemlerin işe yaramadığını görürsem değişik başka yöntemler kullanırım.						
3. Sürdürülebilirlik ile ilgili konuları anlatırken öğrencilerin yüz ifadelerini dikkate alırım.						
4. Sürdürülebilir Kalkınma Eğitiminde öğretim yöntemlerimi öğrencilerin gereksinimlerine göre değiştiririm.						
5. Sürdürülebilir Kalkınma Eğitimi sırasında yaptığım hatalardan ders alırım.						
6. Sürdürülebilir Kalkınma Eğitimi sonunda hedeflerime ulaşıp ulaşmadığımı belirlemeye çalışırım.						
7. Öğrencilerimden aldığım dönütleri sürdürülebilirlik konularını daha iyi anlatmak için kullanırım.						
8. Sürdürülebilir Kalkınma Eğitimi sonunda kendimi değerlendirirken geçmiş yıllardaki başarıyı ölçüt olarak alırım.						
9. Sürdürülebilir Kalkınma Eğitiminde her şey planladığım gibi gittiğinde kendimi takdir ederim.						
10. Sürdürülebilir Kalkınma Eğitiminde başarılı olduğumu görmek beni daha çok çalışmaya yönlendirir.						
11. Sürdürülebilir Kalkınma Eğitiminde mesleki açıdan olumsuz yönde değerlendirilmek beni üzer.						
12. Sürdürülebilir Kalkınma Eğitiminde başarısız olduğumu görmek beni endişelendirir.						
13. Sürdürülebilir Kalkınma Eğitiminde çözemediğim sorunlar olduğunda diğer öğretmenlerden yardım isterim.						
14. Sürdürülebilir Kalkınma Eğitim içeriğini hazırlarken gerektiğinde meslektaşlarımdan yardım alırım.						
15. Sürdürülebilir Kalkınma Eğitimi sonrasında edindiğim olumlu ve olumsuz deneyimleri meslektaşlarımla tartışırım.						

Figure E.1. Öğretmen öz düzenleme ölçeği.

APPENDIX F: PERMISSION FROM ETHICAL COMMITTEE OF THE BOĞAZICI UNIVERSITY

This is the permission from Ethical Committee of the Boğaziçi University.



T.C.
BOĞAZIÇI ÜNİVERSİTESİ REKTÖRLÜĞÜ
Fen Bilimleri ve Mühendislik Alanları İnsan Araştırmaları Etik Kurulu
(Fminarek)



Sayı : E-84391427-050.01.04-149085
Konu : 2023/28 Kayıt no'lu başvurunuz hakkında

10.10.2023

Sayın Doç. Dr. Sevdâ YERDELEN DAMAR

"The Relation of Professional Action Competence in Education for Sustainable Development (ESD) to Sustainability Teaching Outcome Expectancy, ESD Value and Teacher Self-Regulation" başlıklı projeniz ile Boğaziçi Üniversitesi Fen Bilimleri ve Mühendislik Alanları İnsan Araştırmaları Etik Kurulu (FMINAREK)'e yaptığımız 2023/28 kayıt numaralı başvuru 02.10.2023 tarihli ve 2023/10 No.lu kurul toplantısında incelenerek etik onay verilmesi uygun bulunmuştur.

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Saygılarımızla,

Prof. Dr. Tınaz EKİM AŞICI
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APPENDIX G: PERMISSION FROM THE MINISTRY OF EDUCATION

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T.C.
İSTANBUL VALİLİĞİ
İl Millî Eğitim Müdürlüğü



Sayı : E-59090411-20-92093434
Konu : Anket ve Araştırma İzni (Zeynep AYDIN)

14/12/2023

VALİLİK MAKAMINA

İlgi : a) Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 21.01.2020 tarihli ve 2020/2 sayılı genelgesi.
b) Boğaziçi Üniversitesinin 01.12.2023 tarihli ve E-54237038-605.01-156043 sayılı yazısı.
c) Müdürlüğümüz Araştırma ve Anket Komisyonunun 07.12.2023 tarihli tutanağı.

Araştırma Konusu : Sürdürülebilir Kalkınma Eğitiminde (SKE) Mesleki Eylem Yeterliliğinin Sürdürülebilirlik Öğretimi Sonuç Beklentisi, SKE Değeri ve Öğretmen Öz Düzenlenmesi İle İlişkisi (The Relation of Professional Action Competence in ESD to Sustainability Teaching Outcome Expectancy, ESD Value and Teacher Self-Regulation)

Araştırma Türü : Anket
Araştırma Yeri : İstanbul
Araştırma Kişiler : İlkokul, Ortaokul, Lise Öğretmenleri
Araştırmanın Süresi : 2023 - 2024 Eğitim - Öğretim Yılı

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Makamınızca da uygun görüldüğü takdirde olurlarınıza arz ederim.

Doç. Dr. Murat Mucahit YENTÜR
İl Millî Eğitim Müdürü

OLUR

Dr. Mehmet Hüseyin Nail ANLAR
Vali a.
Vali Yardımcısı

Ek:
1- İlgi (b) Yazı ve Ekleri (10 Sayfa)
2- İlgi (c) Tutanak (1 Sayfa)

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Figure G.1. Permission from the ministry of education.

APPENDIX H: CONSENT FORM 1 / KATILIMCI ONAM FORMU 1

This is the consent form for the first stage of the study.

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi

Araştırmanın adı: Sürdürülebilir Kalkınma Eğitiminde (SKE) Mesleki Eylem Yeterliliğinin Sürdürülebilirlik Öğretimi Sonuç Beklentisi, SKE Değeri ve Öğretmen Öz Düzenlemesi ile İlişkisi

Tez Danışmanı: Doç. Dr. Sevda YERDELEN DAMAR

Adresi:

e-posta :

Telefonu: İş :

Cep :

Proje Yürütücüsü/Araştırmacının Adı: Arş. Gör. Zeynep Aydın

Adresi:

e-posta :

Telefonu: İş :

Cep :

Sayın Öğretmen,

Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü yüksek lisans öğrencisi Zeynep Aydın, Doç. Dr. Sevda YERDELEN DAMAR danışmanlığında “Sürdürülebilir Kalkınma Eğitiminde (SKE) Mesleki Eylem Yeterliliğinin Sürdürülebilirlik Öğretimi Sonuç Beklentisi, SKE Değeri ve Öğretmen Öz Düzenlemesi ile İlişkisi” başlıklı tez çalışmasını yürütmektedir. Bu araştırma, sürdürülebilir kalkınma

eğitiminde mesleki eylem yeterliliği ve sürdürülebilir kalkınma eğitiminin algılanan önemi ölçeklerini Türkçeye uyarlamayı ve ilkökul, ortaokul ve lise öğretmenlerinin sürdürülebilir kalkınma eğitiminde mesleki eylem yeterliliğini araştırmayı ve sürdürülebilirlik öğretimi sonuç beklentisi, SKE değeri ve öğretmen öz düzenlemesi ile SKE’de mesleki eylem yeterlikleri arasında nasıl bir ilişki olduğunu incelemeyi amaçlamaktadır.

Katılımın olası yararları ve (varsa) potansiyel risk: Size uygulanacak ölçüm aracındaki tüm sorularda Doğru ya da Yanlış cevap yoktur, sadece ilgili konularda görüşleriniz araştırılmaktadır. Ölçeklerdeki soruları cevaplamanın sizin üzerinizde psikolojik olarak olumsuz bir etki yaratmayacağından emin olabilirsiniz. Çalışma sonuçları kullanılarak sürdürülebilir kalkınma eğitiminde mesleki eylem yeterliliği ile ilgili literatüre katkıda bulunulacaktır.

Onam:

2 bölümden oluşan bu çalışmanın veri toplama araçlarının sizler tarafından doldurulmasına ihtiyaç duyulmaktadır. Birinci bölümde demografik bilgiler (cinsiyet, okul seviyesi ve okul türü, branş, öğretmenlik deneyimi) istenecektir. İkinci bölümde, Sürdürülebilir Kalkınma Eğitiminde Mesleki Eylem Yeterliliği ölçeğinde 31 madde ve Sürdürülebilir Kalkınma Eğitiminin Algılanan Önemi ölçeğinde 3 madde, toplam 34 maddenin cevaplanması beklenmektedir.

Çalışmaya katılmanız tamamen isteğe bağlıdır. Çalışma verileri analiz edilip sonuçlar bilimsel çalışmalarda kullanıldıktan sonra doldurulan ölçekler geri dönüşümsüz olarak yok edilecektir. Katılmamanız veya çalışmadan çekilmeniz durumunda herhangi bir ters tutum veya olumsuzlukla karşılaşmayacaksınız. Çalışmanın herhangi bir noktasında çekilmeniz durumunda verileriniz kullanılmayacak ve geri dönüşümsüz olarak imha edilecektir. Eğer bu araştırma projesine katılarak yapacağımız bilimsel projeye destek vermeyi kabul ediyorsanız, lütfen bu formu imzalayıp bize geri veriniz. Katılımınız bizim için çok değerlidir.

Araştırma ilgili sorularınızı yukarıdaki e-posta adresini veya telefon numarasını kullanarak bize yöneltebilirsiniz. Ayrıca proje ile ilgili olası şikayetlerinizi Boğaziçi Üniversitesi Fen Bilimleri ve Mühendislik Alanları İnsan Araştırmaları Etik Kurulu'nun e-mail adresine yönlendirebilirsiniz.

Saygılarımızla,

Ben, (katılımcının adı-soyadı), yukarıdaki metni okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkanı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir ters tutum veya olumsuzluk ile karşılaşmayacağımı anladım.

Bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Formun bir örneğini aldım / almak istemiyorum (bu durumda araştırmacı bu kopyayı saklar).

Katılımcının Adı-Soyadı:.....

İmzası:.....

Adresi (varsa Telefon No, Faks No):.....

.....

Tarih

(gün/ay/yıl):...../...../.....

Teslim Alan Araştırmacının Adı-Soyadı:.....

İmzası:.....

Tarih

(gün/ay/yıl):...../...../.....

APPENDIX I: CONSENT FORM 2 / KATILIMCI ONAM FORMU 2

This is the consent form for the second stage of the study.

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi

Araştırmanın adı: Sürdürülebilir

Kalkınma Eğitiminde (SKE) Mesleki Eylem Yeterliliğinin Sürdürülebilirlik Öğretimi
Sonuç Beklentisi, SKE Değeri ve Öğretmen Öz Düzenlemesi ile İlişkisi

Tez Danışmanı: Doç. Dr. Sevda YERDELEN DAMAR

Adresi:

e-posta :

Telefonu: İş :

Cep :

Proje Yürütücüsü/Araştırmacının Adı: Arş. Gör. Zeynep Aydın

Adresi:

e-posta :

Telefonu: İş :

Cep :

Sayın Öğretmen,

Boğaziçi Üniversitesi Matematik ve Fen Bilimleri Eğitimi Bölümü yüksek lisans öğrencisi Zeynep Aydın, Doç. Dr. Sevda YERDELEN DAMAR danışmanlığında “Sürdürülebilir Kalkınma Eğitiminde (SKE) Mesleki Eylem Yeterliliğinin Sürdürülebilirlik Öğretimi Sonuç Beklentisi, SKE Değeri ve Öğretmen Öz Düzenlemesi ile İlişkisi” başlıklı tez çalışmasını yürütmektedir. Bu araştırma, sürdürülebilir kalkınma eğitiminde mesleki eylem yeterliliği ve sürdürülebilir kalkınma eğitiminin algılanan önemi ölçeklerini Türkçeye uyarlamayı ve ilkokul, ortaokul ve lise öğretmenlerinin

sürdürülebilir kalkınma eğitiminde mesleki eylem yeterliliğini araştırmayı ve sürdürülebilirlik öğretimi sonuç beklentisi, SKE değeri ve öğretmen öz düzenlemesi ile SKE’de mesleki eylem yeterlikleri arasında nasıl bir ilişki olduğunu incelemeyi amaçlamaktadır.

Katılımın olası yararları ve (varsa) potansiyel risk: Size uygulanacak ölçüm aracındaki tüm sorularda Doğru ya da Yanlış cevap yoktur, sadece ilgili konularda görüşleriniz araştırılmaktadır. Ölçeklerdeki soruları cevaplamanın sizin üzerinizde psikolojik olarak olumsuz bir etki yaratmayacağından emin olabilirsiniz. Çalışma sonuçları kullanılarak sürdürülebilir kalkınma eğitiminde mesleki eylem yeterliliği ile ilgili literatüre katkıda bulunulacaktır.

Onam:

2 bölümden oluşan bu çalışmanın veri toplama araçlarının sizler tarafından doldurulmasına ihtiyaç duyulmaktadır. Birinci bölümde demografik bilgiler (cinsiyet, okul seviyesi ve okul türü, branş, öğretmenlik deneyimi) istenecektir. İkinci bölümde, Sürdürülebilir Kalkınma Eğitiminde Mesleki Eylem Yeterliliğini (31 madde), Sürdürülebilirlik Öğretimi Sonuç Beklentisi (10 madde), Sürdürülebilir Kalkınma Eğitiminin Algılanan Önemi (3 madde) ve Öğretmen Öz Düzenlemesi (15 madde) ile toplam 59 maddenin cevaplanması beklenmektedir.

Çalışmaya katılmanız tamamen isteğe bağlıdır. Çalışma verileri analiz edilip sonuçlar bilimsel çalışmalarda kullanıldıktan sonra doldurulan ölçekler geri dönüşümsüz olarak yok edilecektir. Katılmamanız veya çalışmadan çekilmeniz durumunda herhangi bir ters tutum veya olumsuzlukla karşılaşmayacaksınız. Çalışmanın herhangi bir noktasında çekilmeniz durumunda verileriniz kullanılmayacak ve geri dönüşümsüz olarak imha edilecektir. Eğer bu araştırma projesine katılarak yapacağımız bilimsel projeye destek vermeyi kabul ediyorsanız, lütfen bu formu imzalayıp bize geri veriniz. Katılımınız bizim için çok değerlidir.

Araştırma ilgili sorularınızı yukarıdaki e-posta adresini veya telefon numarasını kullanarak bize yöneltebilirsiniz. Ayrıca proje ile ilgili olası şikayetlerinizi Boğaziçi Üniversitesi Fen Bilimleri ve Mühendislik Alanları İnsan Araştırmaları Etik Kurulu'nun e-mail adresine yönlendirebilirsiniz.

Saygılarımızla,

Ben, (katılımcının adı-soyadı), yukarıdaki metni okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkanı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir ters tutum veya olumsuzluk ile karşılaşmayacağımı anladım.

Bu koşullarda söz konusu araştırmaya kendi isteğimle, hiçbir baskı ve zorlama olmaksızın katılmayı kabul ediyorum.

Formun bir örneğini aldım / almak istemiyorum (bu durumda araştırmacı bu kopyayı saklar).

Katılımcının Adı-Soyadı:.....

İmzası:.....

Adresi (varsa Telefon No, Faks No):.....

.....

Tarih (gün/ay/yıl):...../...../.....

Teslim Alan Araştırmacının Adı-Soyadı:.....

İmzası:.....

Tarih (gün/ay/yıl):...../...../.....