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Chapter 1

PRE-SERVICE SCIENCE TEACHERS' EXPERIENCES OF SIMULATION DEVELOPMENT USING CODING*

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İlbilge DÖKME[2]

Introduction

Historically, Computer Science and Computer Programming were considered essential only for those in IT and engineering fields. However, these disciplines are now recognized as fundamental skills for individuals across all sectors (Linberg, Laine & Haaranen, 2019; Nouri, Zhang, Mannila & Norén, 2020). Recent research has concentrated on understanding programming knowledge and capabilities (Bers, 2019; Lye & Koh, 2014). The incorporation of cutting-edge technologies in educational environments has underscored the importance of these competencies. As a result, it is crucial for upcoming science educators to develop proficiency in programming and coding. During the early phases of coding instruction, block-based platforms (such as Scratch, mBlock, and code.org) are generally preferred (Grover & Pea, 2013). In the realm of science education, coding programs are primarily employed for developing models and creating robotics-oriented programming activities. These tools provide almost endless design opportunities, constrained only by one's creative capacity. Additionally, they serve as invaluable resources for science teachers, facilitating the development of complex simulations on diverse scientific subjects. One of these programs, mBlock, is a frequently preferred platform, especially for those new to coding. mBlock converts drag-and-drop blocks into Arduino C (C/C++ derivative) and Python programming languages. Block-based programming applications are increasingly popular with students of all ages because they make it easier to understand programming logic without the need for text-based coding knowledge (Kesler, Shamir-Inbal, & Blau,

* Some of the findings of this research were presented as a poster at the 15th Conference of the European Science Education Research Association Conference (ESERA 2023 Conference) held in Nevşehir between August 28 and September 1, 2023.

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findings revealed that block-based coding programs like mBlock are useful for developing simulations about science subjects. The views of the pre-service teachers who learned a block-based coding program for the first time indicated that:

- Simulations about science topics can be easily developed using mBlock.
- Block-based coding environment makes the simulation development process enjoyable, entertaining, fun, and interesting.
- Developing simulations with a coding program is beneficial for learning and teaching. Coding programs also give new ideas about simulations for other science subjects.
- Simulations developed using a block-based coding environment can be highly preferred as course content.

In the field of science education, simulations are viewed as valuable educational tools, particularly for teachers in training (Smetana & Bell, 2012). Our research offers significant insights for departments focused on educating science teachers. Notably, even educators without prior coding experience can create numerous science-related simulations using block-based programming. This investigation centered on the perspectives of preservice teachers following their experience in developing simulations. We suggest conducting additional experimental research on the process of creating simulations. Furthermore, we propose investigating how the practice of developing simulations influences the professional self-perception of science educators.

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Chapter 2

EXAMINATION OF SCIENCE TEACHER CANDIDATES' SELF-EFFICACY IN USING SCIENCE LABORATORY ACCORDING TO VARIOUS VARIABLES*

Gamze Şimal GÜNEY YILDIZ[1]
Demet ÇETİN[2]

Introduction

Laboratories are environments of great importance in science education; they enable questions that arise in the mind through observations and abstract perceptions to become concrete and gain meaning, and enable the information obtained to be associated with life (Aydoğdu, 2003; Güneş, Şener, Topal Germi & Can, 2013). One of the environments where students have the opportunity to discover concepts, principles and laws by experimenting and where they can gain the experience of learning by doing and living is, of course, science laboratories (Böyük, Demir & Erol, 2010). While science laboratories encourage students to research, question and examine, they also provide the necessary experience for them to become individuals who can understand the relationship between daily life and science subjects (Kılıç, Keleş & Uzun, 2015). While students gain experience in using tools and equipments in the laboratory, they have the opportunity to acquire practical skills that they can use in the laboratory, such as measuring, detecting and correcting errors. In addition, students who encounter situations such as measurement errors also gain knowledge about the complexity of science (Önder, Tanel & Tanel, 2023). Therefore, it can be said that the most suitable field for the implementation of science education is science laboratories (Aydoğdu & Yardımcı, 2013). In other words, the basis of the science course, which stands out with its experiment and observation, should be the laboratory method. As

* This study was prepared from Gamze Şimal Güney Yıldız's master's thesis titled "Fen Bilgisi Öğretmen Adaylarının Fen Laboratuvarı Kullanımına Yönelik Öz Yeterliklerinin Çeşitli Değişkenlere Göre İncelenmesi", which was prepared in 2024 under the supervision of Prof. Dr. Demet ÇETİN at the Gazi University, Institute of Educational Sciences, Department of Mathematics and Science Education.

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Chapter 3

ATTİTUDES AND THOUGHTS OF SECONDARY SCHOOL STUDENTS TOWARDS SCİENCE LESSONS AND SCİENCE FAİRS*

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Introduction

In today's world, where the production of knowledge has reached unprecedented levels, the primary goal of education should not be to produce individuals who merely memorize information as it is, but rather to equip them with the skills to access and process knowledge (Kaptan, 1999). The importance of science education is undeniable in cultivating individuals who are capable of identifying appropriate strategies when faced with problems, using scientific process skills and higher-order thinking skills to solve problems like scientists, and actively engaging in transforming theoretical knowledge into practice through research and inquiry. In this context, Aydoğdu (2003) stated that the purpose of science curricula is for individuals to engage in an active learning process, meaningfully connecting new information with their existing knowledge. Students should not only receive information in the learning process but also consolidate it through their own experiences. Şener (2018) emphasizes that, especially for young students in primary education, we should focus not just on presenting ready-made information but on teaching them how to access information. This approach helps young individuals develop skills in asking questions, conducting research, and thinking critically. At this point, the importance of science experiments in science education, where permanent learning occurs through hands-on activities, research, and inquiry, stands out once again. While these activities are often

* The brief summary of this study was presented as an oral presentation by the first author at the 16th National Science and Mathematics Education Congress (UFBMEK-2024) held in EDİRNE from September 4-7, 2024.

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These activities help students freely explore, engage in projects, and maintain their interest in science.

It is crucial to provide students with responsibilities to develop their self-confidence and attitudes toward learning. These responsibilities may involve in-class activities, project work, or group projects. It has been observed that students given responsibilities are more motivated and focused on learning. Therefore, encouraging students to take on various roles can foster the development of both their academic and social skills. Applications that promote students' active participation should be developed. In science lessons, activities that allow students to actively explore, make observations, and conduct experiments should be organized, rather than just passively listening to lessons. Such practices can increase students' interest and motivation in science while making their learning process more effective. These recommendations will contribute to making science education more effective and efficient, increasing students' interest in science, and supporting their success.

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Chapter 4

PRE-SERVICE TEACHERS' VIEWS ON STEM-BASED ENVIRONMENTAL EDUCATION WITH ARDUINO MATERIALS

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INTRODUCTION

Considering the process from the past to the present, it is observed that rapid changes have been experienced in more than one field. The basis of rapid changes is the technologies used today. Smart devices, the internet, and software are examples of these technologies (Atsız et al., 2024; Orgaz, Moral & Domínguez, 2018). Considering the change, it is seen that technology affects our lives directly and indirectly. For these changes to have a positive effect, technology should be integrated with the correct fields correctly (Dinçer, 2003).

A country can develop, keep up with the changing world, and move forward continuously through education (Güneş, 2007). For this reason, it is essential to integrate technology into the field of education. The purpose of using technology in education is to enable individuals to access information quickly and use information effectively (Dickinson & Bass, 2020).

Microcontrollers: Arduino

Arduino is an open-source platform that allows the concrete demonstration of the program written to solve a problem where hardware and software processes are used together (Ocak & Efe, 2019; Doğan, 2015). It has a microcontroller card

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learning time management." Similar findings were obtained in the studies of Tağci (2019) and Göksoy and Yılmaz (2018). In their research on robotic coding, they found that individuals' thinking skills improved. Chambers and Carbonaro (2003) determined that individuals' creativity improved in their research. In another study, it was determined that it contributed to individuals' high-level skills, such as critical, analytical, and creative thinking (Gura, 2012).

Finally, the categories obtained in the question regarding the contribution of the materials prepared by the pre-service teachers to the students are as follows: "Gaining 21st-century skills, gaining cognitive domain skills, producing solutions to environmental problems, gaining affective domain skills, increasing interest, gaining psychomotor skills, providing meaningful learning, gaining environmental literacy, gaining higher order thinking skills". Similar to the category of "generating solutions to environmental problems," Kaygısız, Üzümcü, and Uçar (2020) concluded that individuals' problem-solving skills improved. Lamb and Johnson (2011) and Sohn (2014) also reached a similar conclusion. In another study, it was determined that interest, motivation, and problem-solving skills increased (Yolcu & Demirer, 2017). As a result, it was determined that pre-service teachers' views on environmental education and materials based on the STEM approach were positive.

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Chapter 5

PRE-SERVICE SCIENCE TEACHERS' OPINIONS ABOUT BEING A STEM TEACHER: A PILOT STUDY BASED ON THE PERSPECTIVE OF STEM TEACHER IDENTITY

Emine EREN[1]

Introduction

In recent STEM studies, identity has emerged as a novel perspective. Several research have explored various aspects of identity, including discipline-specific identities (Cribbs et al., 2015; Godwin, et al., 2013), teacher identity (Jiang, et al, 2021; Keller, 2018), and learner identity (Simpson & Bouhafa, 2020). Gee (2000) conceptualizes identity as a "type of human" that develops through an individual's actions in particular contexts. Given this understanding, it is logical that shifts in teacher roles within STEM-integrated classrooms influence teacher identity (El Nagdi, Leammukda, & Roehrig, 2018). Studies on STEM teacher identity draw from both STEM disciplines and professional identities. Hazari, et al. (2010) characterized STEM identity using four dimensions: performance, competence, recognition, and content interest. Hanna, et al. (2020) described teacher identity through five dimensions: motivation, self-image, self-efficacy, task perception, and teaching interest. Galanti and Holincheck (2022) suggested that the fusion of these two identity models could form the basis for STEM teacher identity. This model combines Hanna et al.'s (2020) teacher identity model, Hazari et al.'s (2010), and Carlone and Johnson's (2007) STEM learner identity model (Figure 1). The combined model conceptualizes the likely overlap between the components of professional teacher identity and STEM learner identity. Galanti and Holincheck (2022) suggest that there are shared elements and connections between these two aspects of identity.

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personal/professional/social interactions was supported (Akkerman & Meijer, 2011).

There is no STEM department in the teacher training programs of the Council of Higher Education in Turkey, there are only science education departments. These teachers graduate as science teachers. However, science teacher education includes various courses (e.g., interdisciplinary science education, elective courses) as well as STEM studies and practices. We believe that this situation, which is currently limited to certain practices, will be an important part of science education in the future. This paper would be the first study that reveals the opinions about STEM teacher identity in Turkey. We hope that the current and future research findings will shape the transforming process of science teachers into STEM teachers.

Teacher educators should strive to understand the identities to develop and strengthen integrated STEM teacher identities effectively. This understanding can inform the design of professional development programs that support teachers in innovating STEM in their classrooms.

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Chapter 6

EXAMINING MIDDLE SCHOOL STUDENTS' COGNITIVE STRUCTURES AND VISUAL IMAGES REGARDING THE CONCEPT OF LABORATORY

Esra BENLİ ÖZDEMİR[1]
Elif ÖZDEMİR ONAÇ[2]

1. INTRODUCTION

The developments in science and technology of countries have become increasingly important from the past to the present. The level of a country's development is often assessed through its advancements in science and technology. Laboratories play a significant role in achieving these advancements (Çepni, Ayas, Johnson, & Turgut, 1997). Laboratories not only have a crucial role in science and technology but also in education (Aydoğdu & Ergin, 2008). Laboratories provide an important learning environment in education and are considered one of the fundamental components of science education. Unlike traditional teaching methods, laboratories offer students the opportunity to apply theoretical knowledge in practice, which helps deepen learning. Through laboratory activities, students develop scientific research skills, enhance their problem-solving abilities, and begin to understand scientific processes through firsthand experience (Hofstein & Naaman, 2007). Tobin (1990) described laboratory activities as a method that allows students to actively participate in scientific research processes, enabling them to construct knowledge in their minds and learn deeply. Identifying middle school students' perceptions of the concept of laboratory will serve as a guide to improving and developing students' laboratory perceptions in a positive direction, thus enabling more effective and lasting science teaching. In this context, it is important to know how students describe laboratories and how they structure them in their minds (Çıngıl Barış, 2020). The basis of the laboratory environment is activity preparation, experimentation and learning by investigating. These

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3. The materials used in laboratory activities should be diversified to provide students with different experiences. This will help them understand the laboratory concept from a broader perspective.
4. Activities that integrate laboratory practices with other disciplines can help students understand the laboratory concept in a wider context. For example, mathematical modeling, technology integration, and engineering applications can be included in laboratory activities.
5. In-service training programs should be organized for science teachers to enrich the experiments and activities they can conduct in laboratories. This will enable teachers to plan and implement laboratory activities more effectively and play a more active role in guiding student perceptions.

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Chapter 7

EXAMINING THE ENTREPRENEURIAL CHARACTERISTICS OF PROSPECTIVE TEACHERS AND DEFINITIONS OF ENTREPRENEURIAL TEACHERS*

Elvan İNCE AKA[1]

Introduction

Today, rapid changes in the field of information and technology require changes in the characteristics, professional and personal skills of individuals. According to the Partnership for 21st Century Skills [P21] (2009), these skills, which are called "21st century skills", are addressed in three main themes: learning and innovation skills, life and career skills and information, media and technology skills.

Entrepreneurship is defined as the activity of perceiving opportunities and seizing those opportunities (Mueller & Thomas, 2001), producing things that did not exist before by using opportunities and resources effectively (Stevenson & Jarillo-Mossi, 1986), and a way of thinking and behavior that concerns society and economy (Developing Entrepreneurial Graduates, 2008). The concept of "entrepreneur" comes from the Latin root "intare" and is formed by the combination of the English words "enter" and "pre", which means an individual who is the first to enter the business (Korkmaz, 2000).

Considering the increasing importance of entrepreneurship in the field of education (Haara et.al, 2016), entrepreneurial teachers play an important role in helping students acquire the knowledge and skills they need. In the General Qualifications for the Teaching Profession published by the Ministry of National Education in 2017, it is stated that teachers should be role models, do their profession willingly and willingly, and create learning environments that develop high-level cognitive skills in the areas of "Professional Skills" and "Attitude and Values" (MoNE, 2017).

* This study was presented as an abstract oral presentation at the 3rd Internatıonal Congress on Science, Mathematıcs, Entrepreneurship and Technology Educatıon between 30 september - 3 october 2021.

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most frequently emphasized characteristics of the entrepreneur is having high intuition power (Çalışkan Maya, et al. 2012).

Recommendations

According to the results of this study, the following recommendations can be made:

- Pre-service teachers can be supported to develop their existing entrepreneurial characteristics during their undergraduate education by giving them supportive assignments and responsibilities.
- Entrepreneurship courses can be taught as elective undergraduate courses to increase the awareness of candidates.
- Entrepreneurship characteristics can be investigated on different sample groups.
- The effect of pre-service teachers' entrepreneurial characteristics on different variables can be examined.
- Different practices can be tried in gaining entrepreneurship skills.

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Chapter 8

INVESTIGATE THE EFFICACY OF UTILISING ARDUINO MATERIALS WITH A CHATBOT: ACTION RESEARCH

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INTRODUCTION

Role of Arduino Microcontroller Cards in Education

There are many different auxiliary tools for using technology in lessons. One of them is the Arduino microcontroller card. Arduino microcontroller cards are electronic cards with open software and flexible structure in terms of programming and design (Ocak & Efe, 2018). Since Arduino boards enable different projects, they develop digital literacy with problem-solving, critical thinking, creative thinking, entrepreneurship, and design skills and support collaborative learning environments such as teamwork (Akkaş et al., 2020; Latip et al., 2020; Zengin, 2016). For example, Latip et al. (2020) found that using Arduino cards during STEM activities improved students' skills, such as cooperative learning and socialization. In Koçak, Çelik, and Uluyol's (2023) applied research on environmental literacy with pre-service teachers, pre-service teachers were expected to produce solutions to environmental problems using Arduino sets. At the end of the research, it was determined that Arduino-enhanced activities positively improved the environmental literacy of pre-service teachers. Güven and Sülün (2023) examined the effect of Arduino-enhanced activities on secondary school students' technology usage skills and attitudes towards science courses. As a result of the analyses, it was determined that Arduino-enhanced implementations positively affected students' skills toward the use of technology and their attitudes toward the course. Based on the research results mentioned above, it can be said that integrating Arduino technology into education has positive results for students.

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Karaoğlan-Yılmaz, 2023).

Thanks to chatbots, the desired information can be accessed quickly. In this way, it can accelerate the learning processes of individuals by making teaching environments effective. In addition, chatbots can activate individualized learning activities per individuals' personal needs and demands and create a more effective contemporary learning environment than a traditional method (Hobert & Meyer Von Wolff, 2019). Integrating ChatGPT, a chatbot, into this process enables individuals to receive feedback instantly. This way, solutions can be obtained quickly and effectively for a problem.

There are many advantages to using chatbots in the field of education. Among these advantages, the code generation feature is an essential result of this research. Using chatbots in code generation means a teacher can teach a lesson using different disciplines together. Compared to a computer teacher or an educational technologist, other branch teachers may not be expected to be able to produce code to teach their lessons. However, they should use different disciplines together in their lessons. Thanks to this research, they can learn different technologies or microcontroller cards through chatbots or offer such a learning environment to their students. In this way, a more free learning environment where the individual is active can be provided.

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Chapter 9

THE EFFECT OF ROBOTICS ON TEACHER CANDİDATES' ATTITUDES TOWARD TECHNOLOGY USE IN EDUCATION, INNOVATION LEVELS IN DIGITALIZATION AND CODING: PERSPECTIVES OF TEACHER CANDIDATES'

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Introduction

In the 21st century, individuals are expected not only to use various tools effectively but also to possess key skills such as communicating in a socio-cultural context, leveraging technological tools, collaborating with diverse and hybrid groups, participating in environmentally focused projects, and developing research and problem-solving abilities. Equally important is the capacity to take responsibility for managing their own lives and to act independently and autonomously—skills that are essential for thriving in this century's dynamic and interconnected world (OECD, 2005). The literature includes numerous studies on the impact of robotics coding and technology-supported education on enhancing students' 21st-century skills, such as problem-solving, creative thinking, and digital literacy (Bers, 2020; Papadopoulos et al., 2017). The interest of the younger generations in technology and the transition to digital education make it a necessity for teachers and Teacher candidates to develop teaching methods that are suitable for the new generation. However, there are some gaps in the full integration of these practices into curricula and their effective use by teachers from an early age. Studies show that teachers receive inadequate training in integrating robotic coding and technology into their lessons, which hinders the effective use of these practices

* This study is derived from the master's thesis of the second author titled "Examination of Science Teacher Candidates' Attitudes Towards Digitalization in Education and Their Level of Innovation Towards Robotic Coding" (2022).

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- It was determined that a large portion of the teacher candidates who participated in the application had not previously received robotic coding training and thus struggled during the training. Therefore, providing basic robotic coding training to teacher candidates before the application could lead to clearer and more effective results.
- The research duration was planned as six weeks. However, according to the teacher candidates' feedback, it was stated that it would be beneficial for the applications to be longer. Longer-duration applications should be planned in future studies.
- In order to increase the generalizability of the research results, it is recommended that similar studies be conducted with larger sample groups from different geographical regions, educational levels, and socio-economic backgrounds.
- The long-term performance of teacher candidates who participate in robotic coding and digital education applications should be monitored, their professional success should be analyzed, and continuous support should be provided throughout this process. This approach could form an important foundation for sustainable development in education.
- It is recommended that more research be conducted on teacher candidates developing science experiments using robotic coding. These kinds of integrations could support a constructivist approach in science education and offer more effective learning environments.

These suggestions provide a roadmap to strengthen the research findings and make robotic coding applications more widespread and effective in educational processes.

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Chapter 10

A GENERAL OVERVIEW OF CONTEXT-BASED LEARNING STUDIES IN SECONDARY SCIENCE TEACHING IN TURKEY

Ayhan CINICI[1]

Introduction

Current science curricula emphasize the importance of the social, cultural and natural environment in the learning process (1, 2, 3). They, on the one hand, emphasize that these environmental conditions in which the students live should be taken into consideration, and on the other hand, emphasize the importance of providing him/her with a universal perspective (4; 5). Within this framework the science curriculum in Turkey is based on individuals discovering nature, understanding the relationship between human beings and the environment by adopting scientific process skills and inquiry-based approach, and finding solutions to the problems they face (2). It aims to raise individuals who can recognize the problems of daily life, take responsibility for these problems and use the knowledge they learned in science lessons in solving these problems (2). Therefore, it is considered very important that students are encouraged to establish the connection of scientific knowledge and natural phenomena in the curriculum with daily life and to produce solutions to current problems (6).

On the other hand, the results of international assessment programs such as TIMSS and PISA, whose main purpose is to provide data to evaluate and improve the effectiveness of education systems by comparing student achievement at international level, reveal that common problems are encountered in science education in many countries (7). One of the main reasons for these problems is that there is not enough space for practices that will support students to concrete abstract science concepts and enable them to make connections between the course content and daily life problems. In connection with this, their interest in the course material and learning performance decreases (8; 9). Gilbert (10)

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VII. In addition, most importantly, it is recommended to carry out practical trainings (workshops etc.) to improve the knowledge and skills of pre-service or in-service teachers as practitioners.

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Appendix – 1: List of reviewed studies Code References		
Effects of CBL approach on cognitive learning products	**R1**	Aslangiray, H. & Gezer, S.U. (2022). The Effect of REACT Strategy Enriched with Reflective Thinking Activities on Students' Reflective Thinking. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *57*, 74-102.doi:10.9779.pauefd.1017438.
	R2	Ayvacı, H. Ş., Er Nas, S., & Dilber, Y. (2016). Effectiveness of the Context-Based Guide Materials on Students' Conceptual Understanding: "Conducting and Insulating Materials" Sample. *Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 13*(1), 51-78.
	R3	Canpolat, E. & Ayyıldız, K. (2019). 8. Sınıf öğrencilerinin fen bilimleri dersi bilgilerini günlük yaşam ile ilişkilendirebilme düzeyleri. *Anadolu Üniversitesi Eğitim Fakültesi Dergisi (AUJEF), 3*(1), 21-39.
	R4	Demircioğlu, H., Vural, S. & Demircioğlu, G. (2012). REACT stratejisine uygun hazırlanan materyalin üstün yetenekli öğrencilerin başarısı üzerine etkisi. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 31*(2), 101-144.
	R5	Kara, F., & Çelikler, D. (2019). 5. Sınıf "Maddenin Değişimi" Ünitesinde Kullanılan Bağlam Temelli Öğrenmenin Öğrencilerin Başarılarına Etkisi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 15*(1), 216-245. https://doi.org/10.17860/mersinefd.428001.
	R6	Karslı Baydere, F., & Aydın, E. (2019). Bağlam Temelli Yaklaşımın Açıklama Destekli REACT Stratejisine Göre 'Göz' Konusunun Öğretimi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi, 39*(2), 755-791. https://doi.org/10.17152/gefad.345897

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	R8	Karslı Baydere, F., & Kurtoğlu, S. (2020). 5. Sınıf Öğrencilerinin Biyolojik Çeşitlilik Konusundaki Kavramsal Anlamalarına REACT Stratejisinin Etkisi. *Van Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 17*(1), 1015-1041. https://doi.org/10.33711/yyuefd.800921.
	R9	Karslı, F., & Saka, Ü. (2017). 5. Sınıf Öğrencilerinin 'Besinleri Tanıyalım' Konusundaki Kavramsal Anlamalarına Bağlam Temelli Yaklaşımın Etkisi. *İlköğretim Online, 16*(3), 900-916. https://doi.org/10.17051/ilkonline.2017.330230.
	R10	Keskin, F., & Çam, A. (2019). Yaşam Temelli REACT Stratejisinin Altıncı Sınıf Öğrencilerinin Akademik Başarısına ve Fen Okuryazarlığına Etkisi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*(*49*), 38-59.
	R11	Kirman Bilgin, A., & Yiğit, N. (2017). Öğrencilerin "Maddenin Tanecikli Yapısı" Konusu ile Bağlamları İlişkilendirme Durumlarının İncelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 13*(1), 303-322. https://doi.org/10.17860/mersinefd.306003.
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	R13	Tatlı, A., & Bilir, V. (2021). Ortaokul öğrencilerinin bilimsel süreç becerileri üzerine REACT stratejisinin etkisi. *Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi, 43*, 120-144. Doi: 10.33418/ataunikkefd.824326.
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	R16	Erdoğan Karaş, Ö. & Gül, Ş. (2019). 'Hücre ve Bölünmeler' ünitesinin REACT stratejisiyle öğretiminin 7. sınıf öğrencilerinin tutum ve motivasyonuna etkisi. *Uluslararası Türk Eğitim Bilimleri Dergisi, 7* (13), 30-50.
	R17	Göcük, A., & Şahin, F. (2023). Yaşam temelli ve işbirlikli öğrenme yaklaşımlarının ortaokul öğrencilerinin biyoteknoloji ile biyogüvenlik konularındaki duyarlıklarına etkisi. *IBAD Sosyal Bilimler Dergisi*, (15), 306-334.
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	R20	Kara, E., & Akgül, Dönel, G. (2023). The effect of life-based learning applied in science lesson on students' attitudes and motivation. *Siirt Journal of Education, 3*(2), 23-38. DOI: 10.58667/sedder.1293855.
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	R32	Elmas, R., & Eryılmaz, A. (2015). How to Write Good Quality Contextual Science Questions: Criteria and Myths. *Journal of Theoretical Educational Science, 8*(4), 564-580.
	R33	İlhan, N., & Hoşgören, G. (2017). Fen Bilimleri Dersine Yönelik Yaşam Temelli Başarı Testi Geliştirilmesi: Asit Baz Konusu. *Fen Bilimleri Öğretimi Dergisi, 5*(2), 87-110
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	R42	Kara, E. & Dönel Akgül, G. (2022). Ortaokul Öğrencilerin Yaşam Temelli Öğrenme İçin Oluşturdukları Metaforların İncelenmesi. *International Academic Social Resources Journal, 7*(36), 402-410.
	R43	Topuz, F., Gençer, S., Bacanak, A., & Karamustafaoğlu, O. (2013). Bağlam Temelli Yaklaşım Hakkında Fen ve Teknoloji Öğretmenlerinin Görüşleri ve Uygulayabilme Düzeyleri. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 2*(1), 240-261.
Examining the curriculum or textbooks	**R44**	Arık Güngör, B., & Saraçoğlu, S. (2023). Sekizinci Sınıf Fen Bilimleri Ders Kitabı İçeriğinin Bağlam Temelli Öğrenme Yaklaşımı Açısından Değerlendirilmesi. *Eğitimde Yeni Yaklaşımlar Dergisi, 6*(2), 145-172.
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Chapter 11

CURRICULUM LITERACY AND WRITING ACTIVITIES SPECIFIC TO GIFTED STUDENTS: TEACHERS' EXPERIENCES

Seda İHTİYAR ŞAHİN[1]

Introduction

We can liken gifted children to a river or wind carrying immense energy that has the potential to benefit humanity (Kontaş & Yağcı, 2016). Over time, various terms such as gifted, highly intelligent, specially talented, or individuals with high potential have been used to describe those whose intelligence or abilities surpass certain criteria (Gagne, 1985; Renzulli, 1978; Sutherland, 2005). Since the 19th century, studies on intelligence have focused primarily on measuring levels of intelligence and classifying individuals based on these measurements (Demirok, 2022). While different definitions have emerged as a result of various studies and theories, the most widely accepted approach is Renzulli's (1978) "three-ring model." (Renzulli, 2012).

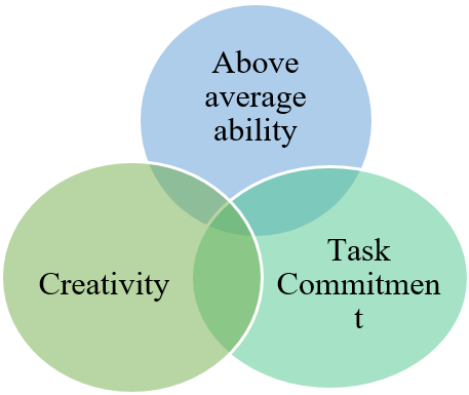

Figure 1. The Three Ring Conception of Giftedness

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been noted that teachers require additional in-service training to further enhance their technological proficiency. The effective use of technology presents a critical opportunity to foster students' creativity and problem-solving skills (Renzulli & Reis, 2014). In evaluation processes, teachers' adoption of process-oriented and performance-based approaches provides a comprehensive understanding of students' development. Nevertheless, the limited use of methods such as peer assessment and collaborative evaluation highlights areas for improvement. Expanding the application of peer assessment can support the development of social skills and help students gain diverse perspectives (Norberg & Johansson, 2010).

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Chapter 12

COMPARATIVE ANALYSIS OF THE 2018 SCIENCE CURRICULUM AND THE 2024 TÜRKIYE CENTURY EDUCATION MODEL SCIENCE CURRICULUM IN TERMS OF SUSTAINABLE DEVELOPMENT THEMES

Elif KARGALIOĞLU[1]

Introduction

The science curriculum focuses on understanding the functioning of nature and applying this knowledge to sustainable development. Topics such as environmental awareness, renewable energy, ecosystem conservation, and the efficient use of resources are fundamental to science education. Sustainable development is a transformational concept that encompasses both the past and the future. In this context, science education helps manage natural resources sustainably by exploring energy transformations, renewable energy technologies, and ecosystem balance. The science course aims to meet human needs without causing environmental degradation and equips students with the skills to build a sustainable future.

The science course enables students to understand the natural world by fostering scientific thinking skills and helps them gain knowledge on topics such as environmental issues, technological innovations, and health. This, in turn, supports the development of critical thinking and problem-solving skills, empowering individuals to contribute to a sustainable future. The inclusion of topics such as ecosystems, energy, matter, natural phenomena, and climate sciences in the curriculum ensures the integration of sustainability themes, including biodiversity conservation, renewable energy, recycling, waste management, and climate change.

Curriculum changes are continuously updated in line with scientific advancements and societal expectations. These updates ensure that students are equipped with the knowledge and skills required by contemporary society, enhancing their critical thinking and problem-solving abilities. Additionally, by

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- The theme of sustainable development should be integrated more systematically. This theme should be emphasized with a clear structure and content at each grade level.

Suggestions for Researchers

- The effects on different age groups should be investigated. The impact of sustainable development themes on students' cognitive and affective development should be studied in detail.
- Long-term studies should be conducted. Comprehensive research should be carried out to evaluate the long-term effects of the curriculum on sustainability awareness.
- An interdisciplinary approach should be supported. Studies should be conducted to examine how sustainable development themes are addressed across different disciplines and how they can be effectively applied.

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Chapter 13

EARTHQUAKE REALITY: AN AWARENESS-RAISING JOURNEY THROUGH ENGINEERING DESIGN-BASED STEM ACTIVITIES

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Introduction

Natural disasters are sudden and often catastrophic events that occur in the atmosphere, hydrosphere, lithosphere or biosphere. These events usually occur as a result of natural processes and can cause serious damage to people, property and the environment. Natural disasters are caused by the interaction of various environmental factors and often require large-scale emergency response and recovery efforts (World Disasters Report, 2004). The impacts of disasters can be multidimensional and long-lasting. In this context, the effects of disasters cannot be completely prevented; however, it is possible to minimise the risks that may occur through integrated natural disaster management for natural disasters. This is only possible by increasing social awareness on natural disasters. However, social awareness and level of preparedness play a critical role in minimising the impacts of natural disasters on people (Paton, McClure, Buergelt, 2003). Increasing social awareness is a fundamental step to ensure a more effective and sustainable fight against disasters. Many studies are carried out by emergency managers, scientists and educators in the world to increase social awareness against natural disasters and to inform the society about the protective measures to be taken against disasters. It is seen that studies to create disaster awareness are increasing in the world.

However, the impacts of natural disasters are not only immediate, but also multidimensional and long-lasting. In this context, despite the effects of disasters that cannot be completely prevented, efforts to minimise possible risks through integrated natural disaster management approaches are important (Cutter et al.,

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take more into account students' experiences and opinions and contribute to their learning processes can be created. In addition, the importance and practical applications of the subject can be emphasized by presenting real-life examples on earthquake and structural safety to students.

3. Suggestions for Reducing Fear and Anxiety Related to Earthquake:

The results in the third category show that students feel safer and overcome their fear of earthquakes by designing earthquake-resistant structures. In this context, educators and guidance counsellors can provide supportive activities and resources to reduce students' fear and anxiety about earthquakes. It is also important to organize awareness-raising campaigns about earthquake safety and risk mitigation strategies and to ensure that students gain safety awareness in this regard.

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Chapter 14

PRE-SERVICE SCIENCE TEACHERS' OPINIONS ON DIGITAL STORYTELLING IN ENVIRONMENTAL SCIENCE COURSE*

Elvan İNCE AKA[1]

Introduction

We see the traces of technology in our education system every day and encounter learning environments where technology is integrated into education. Especially during the Covid-19 pandemic process, it is possible to say that we, as teachers, students and prospective teachers, have benefited from technology in distance education environments. As a matter of fact, in the general competencies of the teaching profession, today's teachers are expected to be individuals who have 21st century skills, can use technology effectively, look critically, solve problems and question (MoNE, 2018). When the studies in the literature (Dağhan, Kibar, Akkoyunlu, & Atanur, 2015; Durak & Seferoğlu, 2017) are examined, it is seen that teachers' effective technology use competence is emphasized, but most of the teachers are not prepared for technology integration (National Science Board, 2002) and teachers continue their lessons with traditional methods (Ursavaş, Şahin, & McIlroy, 2014b). This situation brings to mind the competencies of pre-service teachers regarding technology acceptance. Technology Acceptance Model (TAM) constitutes an infrastructure in determining the acceptance and adequate use of information technologies (Martinez -Torres et al., 2006). TAM is the application of the Theory of Reasoned Behavior developed by Fishbein and Azjen in 1975 (Ursavaş, Şahin, & McIlroy, 2014b).

The development of science education, which is one of the areas where technology use is needed, can be achieved by integrating new tools and technologies into learning environments (Falloon, 2019). Students who gain the habit of using technology by applying it one-to-one in the education and training

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Recommendations

In line with the findings of the research, the following suggestions can be made:

· Candidates should be provided with guidance on digital story templates, video editing tools and visual resources appropriate to environmental science topics.

· Candidates should be guided on how to effectively deliver the message in their stories, how to prepare attention-grabbing questions and how to structure the story.

· Story topics should appeal to students' daily lives and raise environmental awareness.

· Digital story creation activities can be expanded in courses on environmental science and other disciplines for pre-service science teachers.

· In order to improve pre-service teachers' web content knowledge and develop digital stories, courses and activities that enable them to gain these knowledge skills can be planned in their pre-service life before they graduate from faculty.

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Chapter 15

SUSTAINABLE ART EDUCATION IN CREATING ECO-CONSCIOUSNESS*

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Introduction

Increasing environmental problems in today's world have led to a greater awareness of the factors that threaten the ecological balance. Problems such as climate change, depletion of natural resources and the decrease in biodiversity force people to reconsider their relationship with nature. In this context, it is of great importance to spread environmental awareness among individuals and to establish a more sustainable relationship with nature. Education systems play a key role in helping individuals gain ecological awareness and integrate this awareness into all aspects of their lives. it is crucial to approach these issues with sensitivity and to design educational programs aimed at raising awareness from early childhood in a manner that emphasizes experiential learning (Benli Özdemir & Kayabaşı, 2023). In addition to aesthetic values, arts education is a powerful tool for adopting an environmentally sensitive lifestyle (Burns, 2015). Sustainable art education not only teaches the nature-themed aspects of art, but also offers an ethical approach to the use of materials, production processes and the impact of art on society (Silo & Khudu-Petersen, 2016). This educational model enables individuals to increase their environmental awareness through art and spread this awareness to society. These values, especially at a young age, have a significant impact on raising more conscious and environmentally sensitive individuals of the future.

The concept of sustainability continues to affect the history of humanity in a holistic way by expanding the speed it has taken in the age we live in. The

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a global problem, should be addressed together with the concept of sustainability in visual arts education programs, and students should be made aware of eco-consciousness. Studies should be carried out to improve school conditions and a suitable workshop environment should be provided.

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