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Research

Opinion of primary school teachers about the Culturally responsive education practices used in the life Studies Lessons: Implementation of the practices used in the US to Turkey

Emrullah AKCAN [1] **Karen BLAHA** [2]

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Abstract:

Culturally Responsive Education (CRE) has been found to be an effective method of teaching because it focuses on academic success for all students, cultural competencies, sociopolitical aspects, and has been proven effective among school cultures that are diverse in demographics. The aim of this research is to reveal opinion of primary school teachers about the Culturally responsive education practices used in the life studies courses. Within the scope of this aim, culturally responsive practices used in the USA were implemented in classrooms in Turkey, and at the end of these practices, teachers' opinions on these applications were examined. In this study, phenomenology, one of the qualitative research methods, was used. This qualitative research design tries to explain what exactly the experiences of many people about a certain concept or event mean. The working group of this research consists of 14 primary school teachers. In order to collect the main data of the research, interviews were conducted with the teachers using a semi-structured interview form. These collected data were transferred to the computer and analyzed with the help of the MAXQDA 2020 software. In addition to the main data of the research, sociometry and sociogram techniques were used to collect additional data. According to the data obtained, it was determined that these practices had two main effects. One of these main effects is the effect on students and the other is the effect on teachers.

Keywords: Culturally responsive education; Life studies lesson; In-class practices

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[1] Assist. Prof. Dr., Gaziantep University, Faculty of Education, Gaziantep, Turkiye, emrullahakcan@gmail.com
Orcid ID: 0000-0002-5492-4159
[2] Assist. Prof. Dr., University of St. Francis, College of Education Faculty, Joliet, Illinois-USA, kblaha@stfrancis.edu
Orcid ID: 0000-0002-8273-773X

INTRODUCTION

Education is a very broad phenomena and it contains many purposes due to its comprehensive structure. However, to summarize, the most basic purpose of education can be considered as the best adaptation of the individual to the environment in which he/she lives. When the individual starts his/her school life, he/she enters a long process to reach this goal. A student who starts basic education in Turkey starts to acquire many skills and learn many behaviors that will adapt to his/her environment, especially with the lifes studies course. Kabapınar (2007) defines the life studies course as a lesson that focuses on the experiences of the child on how he/she makes sense of the world with his/her birth, helps him/her acquire knowledge, skills and values for his next life, and enables him/her to understand the environment socially and physically. Life studies course is a course that draws strength from social and natural sciences, was created in accordance with child pedagogy, includes information that will enable children to continue their lives as a part of the society they live in, and finally lays the groundwork for higher levels (Baysal, 2006). Sönmez (1998), on the other hand, defines the life studies course as the information obtained at the end of the process in which natural and sociological facts are conveyed through the proof of the individual. As can be understood from the definitions above, the life studies course focuses on social experiences. When the aims of the life studies course are examined, it can be listed as providing students with the basic skills and values related to life, enabling students to recognize and examine the social environment, and to solve the simple problems they encounter (Karasu-Avcı & Ketenoğlu-Kayacıbaşı, 2018; Şahin, 2009; Akcan, 2022a). Life Studies course is one of the most basic courses that will enable students to socialize and prepare for secondary education and daily life (Ekmen, 2019). From this point of view, it is seen that the Life studies course is an important lesson that prepares the individual for society.

Every society has different dynamic factors because societies have different perspectives, lifestyles, problems, etc. The basic notion that creates these differences is culture. Culture is the identity of societies. Culture is formed over time and individuals transfer the culture they have acquired from generation to generation in various ways. Education is one of these ways. From this point of view, education and culture are two phenomena that are very close to each other. While culture directs the society in every aspect, education wants to raise the individual that society needs (Erbaş, 2020). For this reason, it is important that education has a culturally responsive structure. Current research in brain science and education finds that successful comprehension occurs when learners' cultural background knowledge is connected to new learning; all learners successfully process new information when it is connected to what they already know and have experienced (Hammond, 2015). Culturally Responsive Education (CRE) has been found to be an effective method of teaching because it "focuses on academic success for all students, cultural competencies, and sociopolitical aspects and has been proven effective among

school cultures that are diverse in demographics" (Hernandez & Burrows, 2021, p. 338). CRE leverages this brain science by providing instructional and social opportunities for students to connect new learning to their background experiences, culture, and ethnicity. CRE also provides various opportunities for students to demonstrate mastery of new learning. The result is an increase in student achievement.

CRE has been a topic of research for decades, and is considered one of the most effective methods of supporting the learning needs of culturally diverse learners **(**Powell, Cantrell, Malo-Juvera and Correll, 2016; Gay, 2010; Ford, 2010**)**. Gay (2010) has defined CRE as "behavioral expressions of knowledge, beliefs, and values that recognize the importance of racial and cultural diversity in learning" (Gay, 2010, p. 31). CRE is an approach to teaching in which students' culture is nurtured and background experiences are validated (Villegas & Lucas, 2007). In addition, work by Hammond (2014), states that cultural responsiveness develops students' learning capacity by leveraging their cultural frameworks. Regardless of the slightly varied definitions, scholars all identify the core of culturally responsive teaching as the fostering of an inclusive classroom environment that validates students' background experiences (Villegas & Lucas, 2007) and incorporates students' cultures and experiences into the learning process (Blaha, 2019).

Two important factors of culturally responsive instruction are the teacher, and the classroom environment:

CRE provides students with opportunities to represent their cultural backgrounds and build supportive relationships within the class. Additionally, scholars Teel and Obidah (2008), Gay (2010), and Farinde -Wu, Glover, & Williams (2017) identify the following characteristics of a culturally responsive teacher:

- Understands cultural differences are assets, not deficiencies.
- Holds and communicates high academic and behavioral expectations for all students, regardless of background.
- Fosters learning communities in which cultural heritage is respected and valued.
- Uses cultural knowledge to foster meaningful relationships with students, implement instructional strategies, and develop an inclusive environment.
- Utilizes cooperative learning activities.

Culturally responsive teachers also participate in reflective practices concerning their interactions, instruction, and their own cultural lens. According to Muniz (2020), culturally responsive teachers understand that without consistently participating in reflective practices, they run the risk of unwittingly internalizing biases that might impact their instruction, classroom activities, and interaction with their students and their families. Reflective practices help to ensure teachers are providing instruction and social activities that are inclusive and validate students' cultural background.

The classroom environment plays a vital role in the success of students from different culture because diverse learners typically feel anxious and unwelcome in a new classroom

(Lucas, Villengas, and Freedson-Gonzalez, 2008). According to Gay (2002), a culturally responsive classroom demonstrates respect for each other, and displays coherent positive interactions where all students value each other and become a group of students. In addition, Gay (2010) determines two characteristics of a culturally responsive learning environment:

- A culturally environment that validates all students' life experiences and cultural backgrounds into the learning that occurs in the classroom.
- Connections between the school environment and the home culture are encouraged.

When students perceive a discouraging learning environment, such as unsafe conditions, lack of connection, low expectations, they will become disengaged and develop a lowered self-esteem (Claro, Panunesku, & Dweck, 2016; Akcan, 2022b). This, in turn, affects the students' resilience toward academic challenges and social interactions. This stresses the importance of the culturally responsive classroom environment. The culturally responsive classroom environment is as equally important as teacher presence and instructional practices. A culturally responsive classroom is a learning environment that is grounded in respect for student diversity, and emotional and cognitive safety. Simultaneously, students are presented with high expectations and given supports for academic and behavioral success (Gay, 2010, Teel & Obidah, 2008). At its core, the culturally responsive "learning environment is about relationships, communication, and expectations— focusing specifically on students' sense of membership and belonging" (Ford, 2010, p. 51). This sense of belonging and cultural validation is what fuels students' perseverance through challenging tasks and promotes information processing as students make connections between new content and previous knowledge (Hammond, 2014).

In terms of the content of the life studies course, it is a lesson convenient for CRE practices in many aspects such as recognizing, accepting and recognizing different cultures. For this reason, used the CRE practices in life studies courses are also considered important. When the literature was examined, no study was found that focused on life studies and CRE practices. The aim of this research is to reveal opinion of primary school teachers about the Culturally responsive education practices used in the life studies courses. Within the scope of this aim, culturally responsive practices used in the USA were implemented in classrooms in Turkey, and at the end of these practices, teachers' opinions on these applications were examined.

METHOD

Research Model

In this study, phenomenology, one of the qualitative research methods, was used. Phenomenology is a research design that uses experiences to analyze the information

individuals experience in life. This qualitative research design tries to explain the meaning of experiences many people have regarding a certain concept or event. In summary, in phenomenological research, the main point that the researcher focuses on is the experiences of all people participating in the research regarding the notion or event being investigated (Creswell, 2013, Finlay, 2009; Dukes, 1984). The purpose of phenomenological studies is expressed as ensuring that people's feelings and thoughts reach a conclusion depending on their experiences (Dowling, 2007). In short, if a notion, event or phenomenon is meaningful to those who experience it on people's feelings, thoughts and behaviors, a researcher conducting a phenomenological study can collect data from these experience holders. In this study, phenomenological design was preferred because it was aimed to examine the opinions of teachers about the use of culturally responsive educational practices in Turkey, which are frequently used in the USA. Because it is aimed to reveal the teachers' in-class experiences and feelings and thoughts about these educational practices.

Participants

The working group of this research consists of 14 primary school teachers. Detailed information about the participants is given in Table 1. While determining the working group, a 15-minute briefing explaining the purpose and process of the research was given to the primary school teachers working in 10 public primary schools randomly selected by the researchers in Gaziantep, and after this briefing, the teachers who wanted to participate voluntarily in the study were taken into the sample. All of the teachers in the sample have students from different cultures. Demographic data of the teachers participating in the research are given in the table below. At the same time, the participant teachers were given codes such as T1, T2, T3……T14, and direct quotations were given in accordance with these codes.

Table 1

Participants' Judgements of the Order of Fear-type Emotion Verbs on the Scale

Code	Gender	Graduation degree	Age	Year of experiences
T1	Male	Graduate	26-30	6-10 year
T2	Female	Undergraduate	21-25	1-5 year
T3	Female	Graduate	26-30	6-10 year
T4	Male	Undergraduate	21-25	1-5 year
T5	Female	Undergraduate	21-25	1-5 year
T6	Female	Undergraduate	21-25	1-5 year
T7	Male	Graduate	21-25	1-5 year
T8	Male	Undergraduate	31-35	6-10 year
T9	Female	Graduate	21-25	1-5 year
T10	Female	Graduate	26-30	6-10 year
T11	Male	Graduate	21-25	1-5 year
T12	Female	Graduate	36-40	11-15 year
T13	Female	Graduate	26-30	6-10 year
T14	Female	Undergraduate	36-40	11-15 year

A total of 14 classroom teachers, 5 male and 9 female, participated in the research. At the same time, it is seen that teachers are between the ages of 21-40.

Data Collection Tools and Data Collection

In order to collect the main data of the research, interviews were conducted with the teachers using a semi-structured interview form. Interview is a process that is carried out through the interview form in order to examine the phenomenon focused on within the research framework in depth (Creswell, 2019; Şimşek & Yıldırım, 2016). Semi-structured interview forms, prepare for the purpose of obtaining in-depth information with different questions during the interview process, where some of the information and interview questions about the personal information of the participants are structured within the scope of the purpose of the research beforehand (Şimşek & Yıldırım, 2016). The interview questions created by the researchers after the literature review were sent to 5 academicians to get expert opinion. The questions were finalized in line with the feedback from the academicians who offered expert opinions, and then grammar checks were made for the intelligibility of the questions.

In addition to the main data of the research, sociometry and sociogram techniques were used to collect additional data. The sociometry technique is based on the students' ranking of their friends who meet a certain criterion (Elias, Vasilis, Katerina, & Christine, 2016). Sociometry has been used in some studies (Mamas, 2009) aiming to reveal the positions and social interactions of individuals with differences in primary school classrooms. In this study, the reason for using sociometry is the same and it was used to reveal the interaction between students and their in-class positions.

It is possible to see the interaction between students and the position of students in the classroom with the sociometric technique, but there are also some limitations. Making direct observations of children's relationship patterns can help overcome the limitations of traditional sociometric techniques (Elias, Vasilis, Katerina, & Christine, 2016). In this research, photographs were used during in-class activities in order to overcome the limitations of sociometry. Some examples of these photographs are included in the findings section of the research.

The teachers who participated voluntarily in the study used the sociometry technique to reveal the interaction between the students and the sociometry technique before implementing the classroom practices. Afterwards, they used culturally responsive practices that are frequently used in the USA in their life studies courses for 8 weeks. During the process, teachers photographed the students during practices whenever they wanted. At the end of the practices, the sociometry technique was used again in order to determine whether there was a change in the interaction between the students. At the last stage of the study, one of the researchers interviewed the teachers one-on-one and got their opinions on these practices used in life studies courses. Teacher opinions were collected by voice recording from the teachers who gave permission, and through note-taking by the

researcher from the teachers who did not give permission. These collected data were transferred to the computer and analyzed with the help of the MAXQDA 2020 software.

Validity and Reliability

Various measures should be taken to ensure validity and reliability in qualitative studies in which the interview technique is used (Şimşek & Yıldırım, 2016). In order to ensure the validity of this study, expert opinions were taken from 5 academicians and ideas were exchanged about the interview questions. The most convenient method was selected and explained after reviewed the literature. In addition, the data collection process is clearly explained in detail. Information was given about the determination process of the working group and the teachers who were excluded from the working group. Attention was paid to the consistency of the codes and themes formed during the analysis process with the conceptual framework. The obtained data from the participants are included to finding section in direct quotations. On the other hand, in order to ensure the reliability of the research, voice recordings were made with the knowledge of the participants during the interviews. The direct quotations are presented to the reader without researchers comment. By checking the consistency of the data obtained, it was argued in the discussion section with the support of the literature.

Ethical considerations

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were observed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics," which is the second part of the directive, was not taken.

Ethical review board name: Gaziantep University Social and Humanities Ethics Boards

Date of ethics review decision: 06.05.2022

Ethics assessment document issue number: 2022/06

RESULTS

Findings

Sociometry technique was used to the students before the practices within the scope of the research were carried out. In this way, in-class sociometric status of students from different cultures was revealed before the implementation. In addition, after the implementation, the sociometry technique was used again. Figure 1 below shows a sample

sociogram before the implementation and figure 2 shows a sample sociogram after the implementation. These representative sociograms reflects the data of a randomly selected class from the classes.

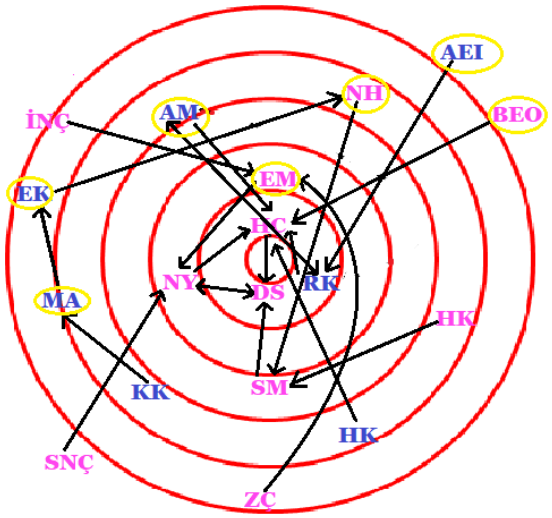

Figure 1: Sociogram before the implementation

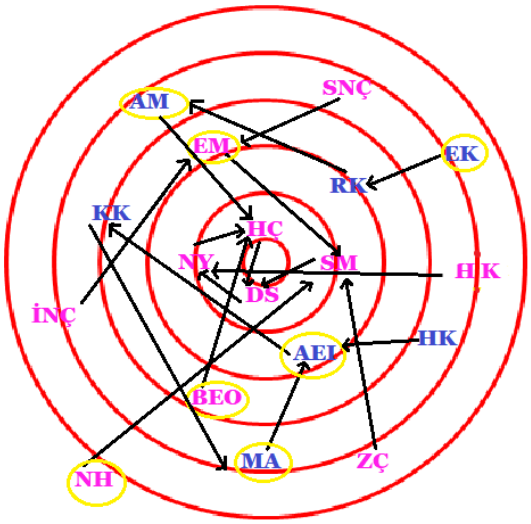

Figure 2: Sociogram after the implementation

In the above sociograms, the codes indicated in blue represent male students, the codes indicated in pink represent female students and the students in the yellow circle represent students from different cultures. Accordingly, when the sociograms are examined, it is seen that the interaction between the students increased after the practices. Especially, it can be said that the interaction between students from different cultures and other students in the class has increased. For example, a male student with AEI code from a different culture was isolated before the practices, but after the practices he found a place towards the center. A similar situation is seen in the female student with the code BEO. When analyzed in general, it is seen that the interaction is relatively low in the first sociogram, and the interaction is more intense in the second sociogram. This situation was determined in all the classes where the implementation was made in the research sample. This positive interaction between students was also supported by the opinions of the teachers. When teachers' opinions were analyzed, the following findings were obtained:

The data collected through semi-structured interviews in the research were analyzed via the MAXQDA qualitative analysis software. As a result of this analysis, two main themes, 7 sub-themes and 90 codes were reached. Detailed information is given below (Image 1).

Code System	90
Effect on Students	0
Positive interaction	25
Cultural awareness	21
Participate in lessons effectively	5
Negative or neutral effect	8
Personal improvement	8
Effect on teachers	0
Recognizing students better	9
Teachers' creativity	14

Image 1: Theme, sub-theme and codes

As seen in the image above, two main themes have been reached in the titles "Effect on students" and "Effect on teachers". Depending on the main theme of "Effect on students, sub-themes of positive interaction, cultural awareness, participate in lessons effectively, negative or neutral effect and personal improvement were reached. Depending on the second theme, "Effect on teachers", two sub-themes were reached under the title of Recognizing students better and teachers' creativity. In order to make the findings more meaningful, code-subcode-segments system and visualization tools were used via MAXQDA.

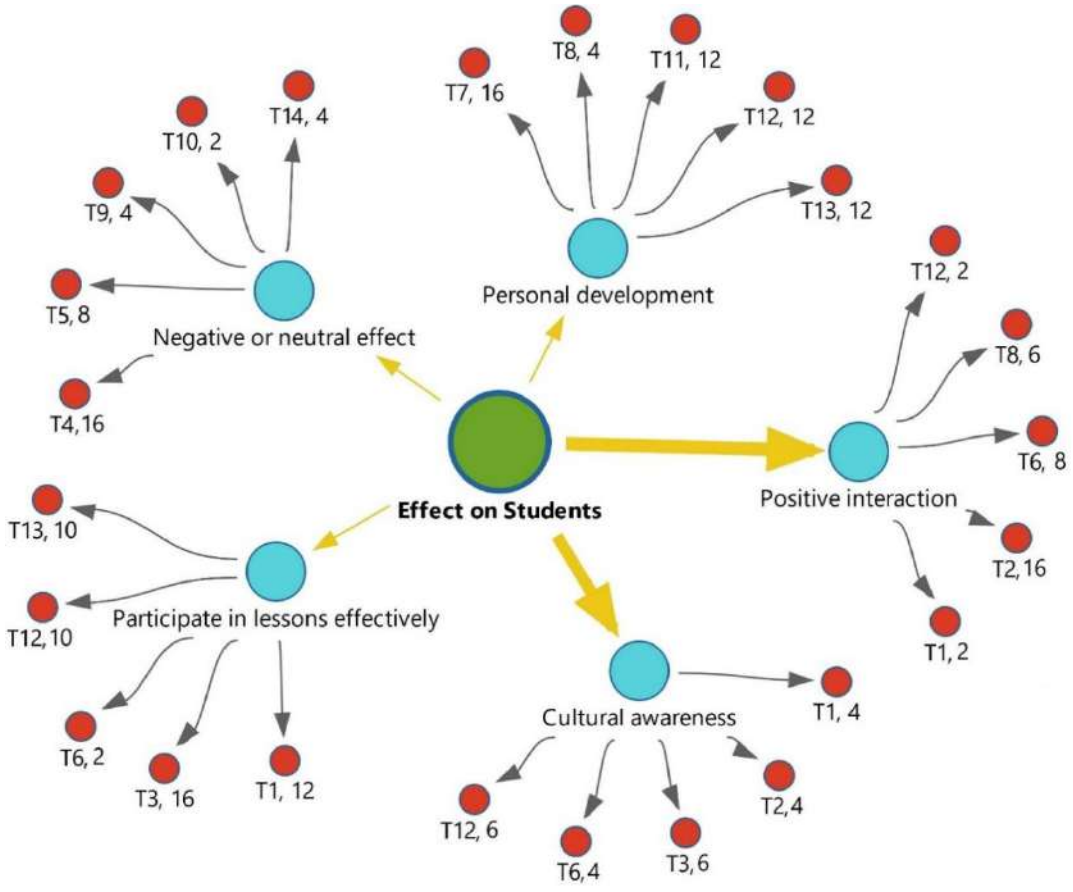

Figure 3: Effect on Students

When Figure 3 is examined, it is seen that the culturally responsive practices implemented in the classrooms are very effective among students, especially in the context of *positive interaction* and *cultural awareness*. In addition to these two sub-titles, it is seen that it also comes to the fore the titles of *participate in lessons effectively* and *personal development*. However, some of the teachers stated that the practices had a negative or neutral effect. The opinions of some of the teachers on the practices are given below in detail, using direct quotations.

In the interviews, it was emphasized that the positive interaction is the situation that has the most impact on the students after implementation. Some quotes emphasizing *positive interaction* are as follows:

> *"…students became more interested in each other, I saw them asking questions about their friends. After the My Name event, they wanted to ask each other's names and birth stories again and listen to them a second time. Practices contributed positively to socialization, communication and self-expressionSimilarly, they found a very good environment to share their thoughts in the "four corners" event. …" (T1).*
>
> *"…They developed a positive communication towards each other. Most of all, they gained respect for differences and effective listening skills…" (T6).*

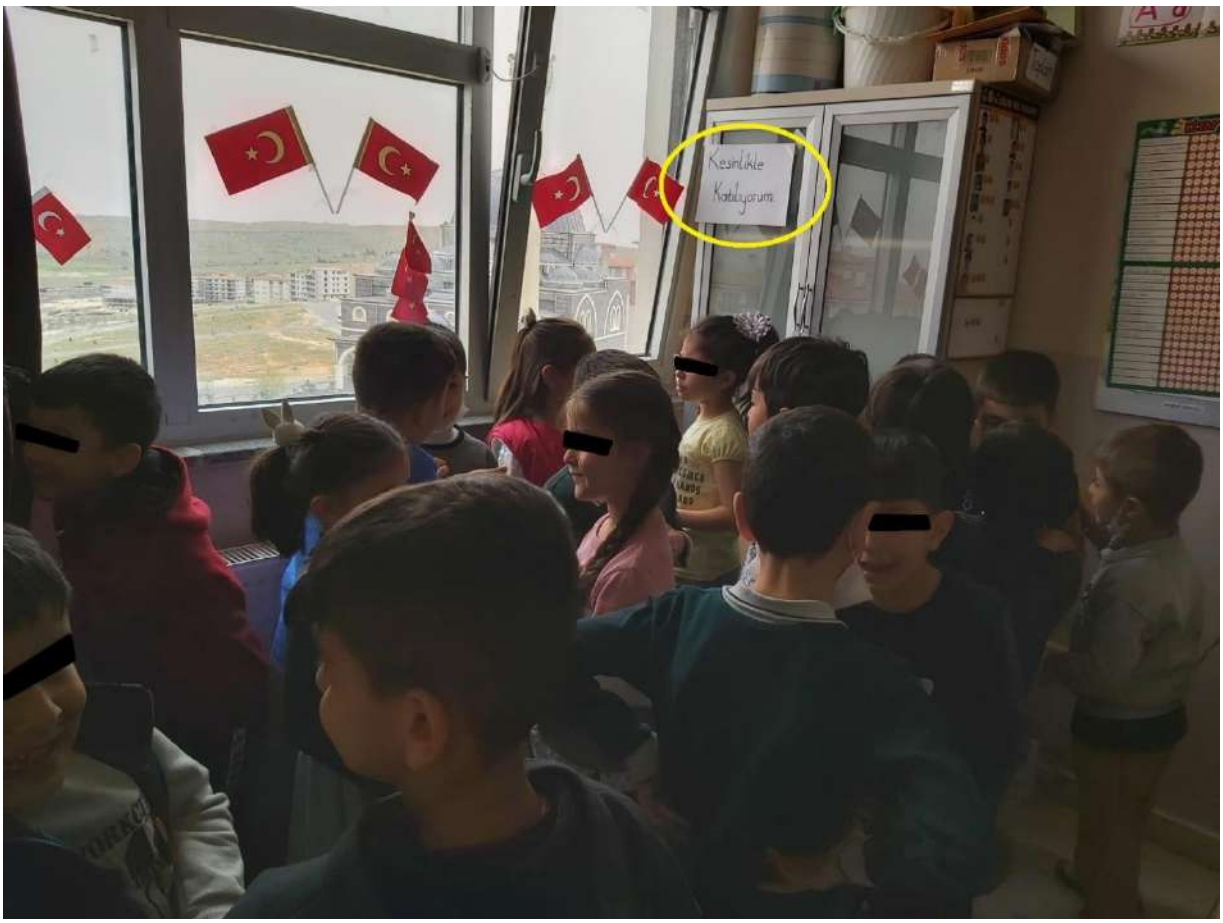

Image 2: positive interaction in "four corner" event

Image 2 is photographed during the four corner event, which increases positive interaction. As seen in the image 2, students share their thoughts about why they chose the option they chose with their peers.

It has been found that cultural awareness is one of the most important effects of these practices on students in classrooms where culturally responsive practices are held. Some teachers' opinions regarding this finding are as follows:

> *"…students got to know each other much better. Students learned about the cultural structure of families in the "My Family's treasure box" event, learned about their interests in the "interview student", gave extensive information about themselves in the "All about me" event, and had the opportunity to get to know their cultural backgrounds better with the origin of their names in the "My Name" event…" (T3).*

> *"…they were able to get to know each other better. In addition, when they saw that some of their cultural characteristics were similar, their understanding of each other was greater. As they learned about the different characteristics of different cultures, their ability of research developed…" (T6).*

Image 3: Step Forward event

Image 4: My family Treasure box event

Among the research findings, it has been determined that an important situation is Personal improvement. Some teacher opinions emphasing this situation are given below:

"…Their skills such as expressing themselves and speaking in front of people have improved. I also noticed improvement in questioning skills…" (T7).

"…I think that students' sense of curiosity develops by asking more questions about each other. I think the step forward event and the four corners event teach respect for different opinions. One student was upset when he selected an option alone in the four corners event, but another student said "not everyone can be the same opinion". The same experience happened in the step forward event. I think that these practices also contribute to the ability of students to express their thoughts comfortably…" (T11).

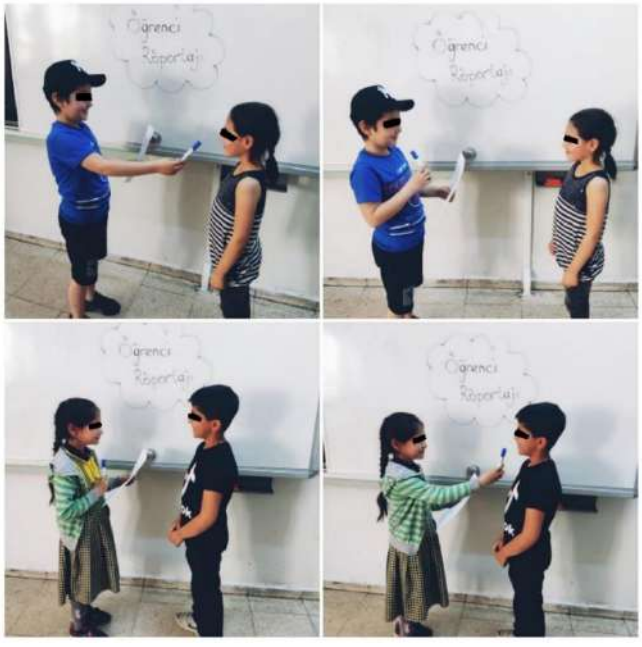

Image 5: Interview student event

In the interviews with teachers, it was stated that these practices enabled more participation of the students in the lessons. According to this finding, the teachers stated that the students who did not participate in the lessons before implementing these practices participated in the lessons more after the practices. Some of these findings are as follows:

> *"…every diverse activity in the classroom increased the energy of the students, they became more active in the lessons throughout the day. …"* ***(T3).***

> *"…my students became more active in the lessons, participation improved positively. friendships have changed and diversified. The number of close friends among students increased. I noticed that students who are passive and alone in the lessons are more active in the classroom and among their friends. Thanks to these activities, the all of the students got to know each other and developed friendships…"* ***(T12).***

Although the majority of the findings obtained from the interviews with the teachers were described as positive, it was also stated that these practices had negative or neutral results in some classrooms. Below are a few examples of negative or neutral status:

> *"…I don't think it was very effective because the students were a bit reluctant and could not completely participate…"* ***(T10).***

> *"…I can't say that these practices are enough. Because students from different cultures have a big language problem. They are poor in communication. Turkish speaking level of the students coming this year is a little low. Although students from different cultures tried to communicate with each other they had difficulty in communicating. Therefore they got bored after a while and turned to their other friends. Unfortunately, this situation prevents them from learning the things of other cultures…"* ***(T4).***

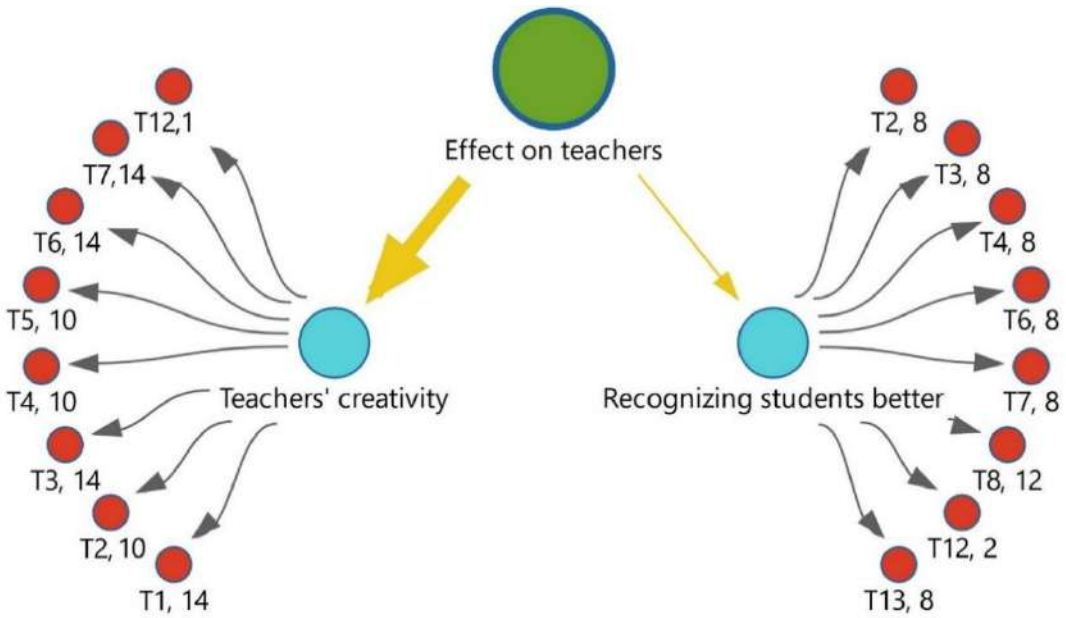

Figure 4: Effect on teachers

With the code-subcode-Segment model, the main theme and sub-themes were visualized and the views of the teachers on these themes are given below through direct quotations.

The second theme, which consists of the findings obtained within the focus of the research, was determined as the effects of the practices on the teachers. Accordingly, it has been revealed that culturally responsive educational practices are also effective on teachers. This main theme is shaped as two sub-themes. One of these sub-themes is that practices make teachers more creative. The other theme states that teachers get to know their students better thanks to these practices. Below are some representative teacher opinions on both sub-themes:

In the interviews, the teachers emphasized that the practices increased their creativity. Some quotations expressing these views are as follows:

> *"…gave me a new perspective. I think they are very useful especially the KWL Chart practice. In addition to Life Studies course, I planned to introduce the music of different cultures in the music lesson. I can make a presentation with costumes belonging to different cultures in the art lesson…"* ***(T2).***

> *"…I was able to develop new practices. For example, there is a magic button in the classroom. The students who presses this button ensures that the student they want gets information about their culture…"* ***(T5).***

> *"…There were practices that I thought I could change and use for lesson aims…"* ***(T6).***

> *"…In general, I adapted the practices interdisciplinary. I cannot say that I have developed new practices. But I tried to adapt them all to different lessons…"* ***(T12).***

Another effect of the practices on teachers was *Recognizing students better*. Some of the teachers' opinions expressing these findings are as follows:

> *"…Thanks to these practices I think recognized my own students better. For example, in the Four Corners and My Name events, I got interesting information about my students from different cultures. Knowing what they like and dislike will guide me in my behaviors in the following lessons…"* ***(T4).***

> *"…I recognized my students much better. I have learned a lot about them that I didn't know. For example, the treasure box or the my name events helped me learn about efficient information about my diverse students…"* ***(T2).***

> *"…These practices actually changed my perspective. At the same time, I learned more about the family structures of my diverse students. In this way, I had the*

opportunity to get to know their cultures closely, and when I saw their family life, I could understand them better and be more responsive to them…" ***(T13).***

DISCUSSION, CONCLUSION and RECOMMENDATIONS

In this study, the views of primary school teachers on the use of culturally responsive educational practices, which are frequently used in the USA, in Turkey were examined. In this context, interviews were conducted with primary school teachers who used these practices in life studies courses, and according to the data obtained, it was determined that these practices had two main effects. One of these main effects is the *effect on students* and the other is the *effect on teachers*.

As an alternative to traditional approaches, there is a very important issue that requires radical changes in schools and classrooms: Culture. Schools that reflect a dominant culture also put culturally diverse students at a disadvantage (Savage, Hindle, Meyer, Hynds, Penetito & Sleeter, 2011). Erickson (2010) provides a comprehensive overview of how culture in schools is reflected at many levels, visible and invisible, that has an impact on students. Lack of connectivity and low engagement between school and student have been related with the lack of culturally responsive practices (Castagno & Brayboy, 2008; Cothran & Ennis, 2000). As can be seen, it is stated that culturally responsive educational practices are very effective on students from different cultures in the classrooms. When the effects on students, which is the first finding of this research, are examined, it is seen that culturally responsive educational practices have very positive effects on all students. Therefore, it can be said that the results of the research are in parallel with the literature. When Figure 3 is examined, it is seen that culturally responsive education practices have positive effects on students such as personal development, positive interaction, cultural awareness and participation in lessons. Culturally responsive practices have been found to have a positive impact on students' self-image and provides them opportunities to feel connected to the learning environment (Wanless and Crawford, 2016). Furthermore, this teaching approach can increase student engagement, enrichment, and achievement (Ford & Russo, 2016) because "children's culture defines what they will focus their attention on, how they interpret the world to give it meaning, ...and how they will value that learning" (Tileston & Darling, 2008, p. 9). Studies by Ladson-Billings (2014) state that culturally responsive teaching "empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes" (p.20). This approach has been found to make students feel welcomed, supports the development of a positive self-image, and helps students feel connected to the learning environment (Wanless and Crawford, 2016). Furthermore, the approach can impact student engagement, enrichment, and achievement (Ford & Russo, 2016).

However, some teachers also stated that these practices did not provide any benefit. The reason for this negative or neutral effect may be the negative perceptions of teachers

towards students from different cultures in the classroom. Akcan (2022c) revealed in his research that some teachers are insufficient in terms of cultural responsivity. In addition, some studies indicate that teachers have low expectations for students from different cultures (Marie, 2006; Cannella & Reiff, 1994). These findings emphasized how important it is for teachers to be responsive to different cultures. In relation to this important situation, when the effects forming the second main theme of the research (Figure 4) are examined, it was determined that the culturally responsive educational practices used in the classroom improved sufficiency in teachers. One of these sufficiency is to recognise students better, and the other is to develop teacher creativity. It is important that teachers "learn about the cultures represented in their classrooms, respect students' values, make connections, and view differences as strengths, not deficits" (Orosco & O'Connor, p. 371, 2011). As culturally responsive teachers learn about their students' cultural experiences, they are then able to validate those cultures in the classroom, and use them to implement instruction. According to Gay (2002), "explicit knowledge about cultural diversity is imperative to meeting the educational needs of ethnically diverse students" (p. 107).

As a result, the use of culturally responsive practices in Turkey has been found to be effective on both students and teachers. For this reason, the use of such culturally responsive educational practices in Turkey, which is hosting more and more cultures both with its own internal dynamics and external migration, brings out very important results. Based on the results of this research, the following recommendations can be represents:

- National and local initiatives are needed to improve teachers' perceptions and attitudes towards different cultures in a positive way.
- This qualitative study was conducted on a limited sample. Therefore, a larger sample can be studied to overcome this limitation.
- The sufficiency of teachers to develop culturally responsive educational practices should be increased.

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Biographical notes:

Dr. Emrullah AKCAN: Assistant Professor at Gaziantep University. He received his undergraduate, master and PhD degree in the Department of Primary Teacher Education from Istanbul University. He is study second PhD degree in the Department of Education Administrative from Kocaeli University. His main research interest in Inclusive education, Equity in Education, Diversities in Education, Culturally Responsive Education, Life Studies, educational movies in primary education.

Dr. Karen BLAHA**:** Karen Blaha is an Assistant Professor in the College of Education at the University of St. Francis. She instructs candidates in the Educational Leadership Program.

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Research

The Effects of the Digitally Supported Multimodal Print Texts on Students' Summarization Skills

Bilal Şimşek [1]

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Abstract:

The aim of this study is to analyse the effects of the multimodal texts created from print texts through the addition of digital mode on the students's summarizing skills. Through the ROAR the digital modes were integrated into the print texts and the multimodal texts were produced. There are two such texts, one of them is an informative text, and the other one is a narrative text. The participants of the study were 128 seventh-gradesecondary school students from Antalya province (Türkiye) whose ages range between 12 and 13. They were randomly assigned to the experimental and control groups. At the pre-test step both groups read and summarized the print texts. In the post-test step the experimental group read and summarized the multimodal texts created by adding a digital mode whereas the control group the print texts. The results showed that there was a significant difference in favor of the experimental group in the total scores and content scores concerning the informative and narrative texts. On the other hand, it is found that the form and style scores from the informative and narrative texts did not differ significantly between the groups. In addition, in the post-test results of the experimental group, there was a significant difference in favor of the narrative text. - The results show that the use of the multimodal texts haspositive effects on the participants' summarizing skills.

Keywords: Use of technology in education, Turkish language education, reading education, multimodal texts, summarizing

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[1] Dr. Resarch Assistant, Akdeniz University, Faculty of Education, Antalya, Türkiye. bilalonursimsek@gmail.com
Orcid ID: 0000-0002-2738-4898

INTRODUCTION

The main purpose of reading activity is to understand the target text. Understanding the text involves along many mental processes. The individual's ability to identify, understand, remember, and express the information in the text after the reading process is among these mental processes. Remembering the text after reading it and re-presenting it by removing unnecessary details are related to an individual's summarization skills. In the Turkish Language Association's current Turkish dictionary (2023) defines summarizing as the activity of telling the content of writings, topics, or movies using fewer words, giving their essence, or making them shorter. Summarizing is the ability to create content based on a source text. Students reach the main idea by extracting details from the text they read. They then create a new text by expressing the main idea and side ideas in their own sentences. (Eggen & Kauchak, 1992). Thus, summarizing is a process that includes the following subskills: recognizing the significant parts of a text (Epçaçan, 2018; Garner, 1987; Karada, 2019; Westby et al., 2010), eliminating the less significant parts (Kurnaz & Akaydn, 2015; Kuşdemir & Güneş, 2014; Raju & Allarpu, 2017; Wormeli, 2004), identifying the main idea ofthe text (Karatay & Okur, 2012; Klein, 1988; Slavin, 2013; Williams, 2007) and paraphrasing the significant parts shortening them in a new form (Demirel, 1999; Demirel & Şahinel, 2006; Gupta & Lehal, 2010; Karatay & Okur, 2012; Kurnaz & Akaydın, 2015; Kuşdemir & Güneş, 2014; Raju & Allarpu, 2017; Slavin, 2013; Ülper & Karagül, 2011; Westby et al., 2010; Wormeli, 2004). In other words, summarization is a skill that involves the process of reading and selecting the important parts of the source text and reconstructing it in a semantically integrated and consistent way with the original structure of the text (Çetinkaya et al., 2020). Senemoğlu (2018) states that although summarizing is a cognitive product, it is also closely related to the act of narration.

Summarizing helps to understand texts (Deneme, 2009). In the summarizing skill, the readers are expected to select important information, coherently organize this information, and report it in their own words (Fiorella & E-Mayer, 2015; Friend, 2001; Ježek & Steinberger, 2008). What a good reader should have is the ability to infer from the text, identify the keywords related to the text, and find the main idea of the text (Azizoğlu & Okur, 2020), and all these are required for a good summarizing act. Van Dijk and Kintsch (1983) argue that summarizing is closely related to -making sense of texts. Because the most important stage of a quality summarization is the understanding of the text (Pečjak & Pirc, 2018). The reader's or listener's ability to -shorten a text to its main points refers to the fact that they have a good grasp of the text content, while their inability to summarize the text may indicate that they have misunderstood the text (Cho, 2012; Kim, 2001). Summarizing is one of the most significant elements of reading and writing skills (Graham & Perin, 2007). Therefore, summarizing can help the students understand the text and at the same time, to clarify an unclear topic (Anderson et al., 1991). In addition, summarizing helps students form general definitions from the text, produce statements that relate ideas, and identify unimportant information (Eggen & Kauchak, 2010).

In Türkiye the skill of summarizing is included in the learning objectives of the Turkish language course program (Ministry of National Education, 2018) for the fifth through eighth grades under the framework of the listening and reading skills. The specific learning objectives concerning summarizing are given as follows: "*Students summarize what they have listened/watched"* and *"Students summarize what they have read*". In addition, for grades 7 and 8. there is also a learning objective under the reading skill of "*Students make use of reading strategies*" as follows: "*Students are provided to use*

reading methods and techniques by browsing, summarizing, taking notes, marking, and discussing". There is also another related objective for the grades of 7 and 8. under the writing skills, namely students make use of writing strategies as follows: "*Students could make use of various writing methods and techniques such as note taking, summarizing, free writing, controlled writing, writing by choosing from the pool of words and concepts, writing from a text and writing using the senses*". It is seen that summarization skill is related to various linguistic skills, and therefore, the multimodal texts can be used in summarization related activities since such texts can appeal to different linguistic skills.

Multimodal texts have two more modes in terms of linguistics (vocabulary, grammar, written language features, etc.), visual (color, drawing, motion, and still image etc.) and audio features, (sound, music effects, rhythm etc.), gestures (facial expression, body language etc.) and spatial features (proximity, direction, location, size, order etc.) (Anstey & Bull, 2010; Shanahan, 2013). Walsh (2006) states that multimodal texts are texts in which both modes are used to make sense of texts. Bearne and Wolstencroft (2007) define such texts as texts in which text, words, still and motion images are used simultaneously. The common point in the related literature is that print texts, visuals, animations, speech sounds, music and graphics are each a mode. In printed texts before the twentieth century, the meaning was primarily conveyed through writing (Lewis, 2001). However, after the twentieth century, in addition to writing, modes such as pictures, graphics and drawings began to be used in texts. With the rapid adoption of technology in every field, digital texts produced with digital modes (video, sound, image, animation, etc.) and such texts have - started to be used. In addition, the features of physical and digital texts are combined with augmented reality technology (Danaei et al., 2020; Tobar-Munoz et al., 2017). Given that texts with physical and digital modes appeal to multiple senses, such texts can contribute to the ability to summarize. These texts, which activate both reading and listening/watching skills in the same text, can support comprehension skills, and the development of comprehension can have positive effects on students' summarization skills (Berkeley et al., 2010). In this context, the study aims to examine the effect of multimodal texts created by adding digital modes to-print texts on students' summarization skills. In line with this aim, the study attempts to answer the following research questions:

RQ1: What is the effect of digitally supported multimodal print texts and multimodal print texts on students' summarization scores?

RQ2: What is the effect of different text types on the student's summarization scores?

METHOD

Research Research Model

The study was designed as quasi experimental research with pre-test and post-tests with experimental and control groups. The main purpose of the experimental research is to test the cause-effect relationships between the dependent and independent variables (Büyüköztürk et al., 2019). The quasi-experimental design was preferred in this study, which was carried out to determine the effects of texts in physical and digital modes on students' summarization skills.

Participants

The participants of the study were 128 seventh grade secondary school students from Antalya province (Türkiye) whose ages range between 12 and 13. The sample size was determined using the G*Power program. Participants voluntarily participated in the study. Prior to the study, necessary

permissions were obtained from the school administration, and informed consent forms were obtained from the parents of the students. After granting the permissions, 64 of the students were randomly assigned to the experimental group and the remaining 64 students to the control group. The descriptive data about the participants are given in Table 1.

Table 1

Demographical Information About the Participants

Demographical information		Experimental group		Control group	
		n	%	n	%
Age	12	24	37.5	21	32.81
	13	40	62.5	43	67.19
Gender	Boy	31	48.4	29	45.3
	Girl	33	51.6	35	54.7
Experience -with using a tablet	Users	62	96.9	63	98.4
	Non-users	2	3.1	1	1.6
Having a tablet	Having	48	75	45	70.3
	Not having	16	25	19	29.7

Data Collection Tools

Digital modes were added to the print texts to create multimodal texts. The first two texts were identified from the seventh-grade textbooks based on the views of two field specialists. One of these texts was an informative text and the other was a narration. Both texts can be considered multimodal in the sense that they contain written and visual materials. The relevant digital content was then investigated. In order to integrate the digital content in a video format that would reflect the plot of the text, the existing sounds in the video were eliminated. Next, audio recordings of the places identified in the text were taken, and the recordings were videotaped. The part of the text that was recorded on video was removed from the reading text. Thus, there was no difference in the flow of the text. The ROAR Augmented Reality application was used to integrate digital content into printed texts. The image in the text and the video created on ROAR's website are matched (Figure 1). In this way, the images in the text can be animated in the video format by using the ROAR application through a technological device.

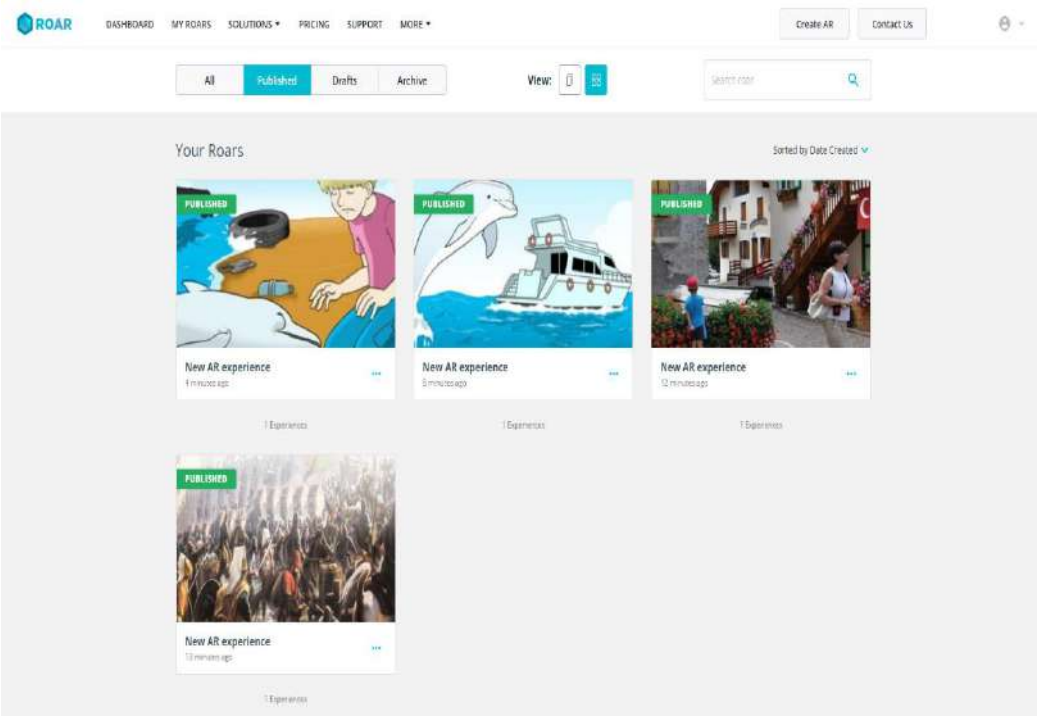

Figure 1. *Images Matched via the ROAR Application Website*

After the completion of the integration of the texts from the 7. grade textbook with the digital content the pre-test step was initiated. During this process, the university first obtained permission from the ethics committee, and then the Antalya Provincial Directorate of National Education granted application permission. Then, the school where the implementation would be carried out was determined. The implementation was planned to be carried out in the Turkish language course. Within the scope of the plan, the school administration and Turkish teachers were informed about the application. In addition, the activity to be used in the implementation was introduced to them. The teachers were with the researcher in the classroom during the implementation. The regular course process took place between the pre-test and post-test periods. During the pre-test period, the students in the experimental and control groups read the printed texts and wrote summaries of the texts. After the data were obtained, the activities were carried out with different texts using tablets so that the experimental group could join the activity comfortably. Through these activities, it was aimed that the experimental group would feel comfortable in the reading activity that they would perform using a tablet in the post-test phase. In the process, no intervention was made in the control group. In the post-test phase, the experimental group read the printed texts created through the ROAR application. These texts were read via tablets that could provide a digital mode. The control group read only printed texts. After the summary writing activity, the post-test data of both groups were collected. The summaries produced by the participants in the pre and post-test steps were evaluated using the scoring key for the summaries developed by Benzer et al. (2016). The scoring key has the following dimensions: format (paper layout; number of paragraphs; grammar, punctuation, typos) with; content (semantic integrity, introductory sentence, plot, secondary ideas, points about details, use of keywords, main idea); and style (use of tenses, direct quotations or direct references to the original text). The author and two field experts participated in the evaluation process. The Kendal's W coefficient of the agreement was used to calculate inter-rater reliability.

Data Analysis

In the data analysis first the kurtosis and skewness values of the pre-test and post-test data were calculated. The results are given in Table 2 and Table 3.

Table 2

Skewness Kurtosis Coefficients of the Pre-Test Results of the Experimental and Control Groups

	Group	N	Skewness	Kurtosis
Total score for the informative texts	Experimental	64	.058	-.163
	Control	64	-.651	-.040
Form of the informative text	Experimental	64	-.335	-.429
	Control	64	-.336	-.624
Content of the informative text	Experimental	64	-.076	.151
	Control	64	-.478	-.569
Style of the informative text	Experimental	64	-.030	-.356
	Control	64	.200	-.546
Total score for the narrative texts	Experimental	64	.426	-.335
	Control	64	-.328	.029
Form of the narrative text	Experimental	64	-.455	-.299
	Control	64	-.533	.004
Content of the narrative text	Experimental	64	.466	-.479
	Control	64	-.081	-.773
Style of the narrative text	Experimental	64	-.164	-.814
	Control	64	.000	.002

Table 3

Skewness Kurtosis Coefficients of the Post-Test Results of the Experimental and Control Groups

	Group	N	Skewness	Kurtosis
Total score for the informative texts	Experimental	64	-.651	-.040
	Control	64	-.255	-.410
Form of the informative text	Experimental	64	-.336	-.624
	Control	64	-.588	-001
Content of the informative text	Experimental	64	-.478	-.569
	Control	64	-.158	-.293
Style of the informative text	Experimental	64	.200	-.546
	Control	64	-.044	-.057
Total score for the narrative texts	Experimental	64	-.328	.029
	Control	64	.126	-.096
Form of the narrative text	Experimental	64	-.533	.004
	Control	64	-.450	-.191
Content of the narrative text	Experimental	64	-.081	.773
	Control	64	.314	.410
Style of the narrative text	Experimental	64	.000	.002
	Control	64	-.015	-.581

Given that the skewness kurtosis coefficients are between -1 and +1, it is possible to state that the data has a normal distribution (Huck, 2012). As the skewness and kurtosis coefficients are close to zero, it can be argued that the data distribution approaches normality. The data from the pre- and post-test period show that the results are in the range between -1 and +1. In order to reveal any difference between the experimental and control groups, the independent samples t-test was employed. The dependent samples t-test was used to determine whether there was a statistically significant difference between the pre-test and post-test scores of the experimental and control groups in terms of in-group patterns. The Cohen d was calculated to determine the effect size of this difference. As stated above, the Kendal's W coefficient of the agreement was used to calculate inter-rater reliability. For the pre-test it was found to be .937, and fort he post-test it was found to be .956.

Ethical Considerations

In this study, all rules stated to be followed within the scope of the"Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: Akdeniz University Rectorate Social and Human Sciences Scientific Research and Publication Ethics Committee

Date of ethics review decision: 20.12.2022

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RESULTS

The data obtained from the pre-test showed that there was no significant difference in the 95% confidence interval between the scores of the students in the two groups. This is also true for the two types of text and the three sub-dimensions of summarization (form, content, and style) (Table 5). The results of the post-test indicate that there is a significant difference between the scores of the students in the dimensions of total score in informative text, form in informative text, total score in narrative text and form in the narrative text (Table 6). In addition, the pre-test and post-test mean scores and standard deviations of the groups are given in Table 5.

Table 4

Mean and Standard Deviation

			Ön test		**Son test**	
	Group	N	Mean	Sd	Mean	Sd
Total score for the informative texts	Experimental	64	26.2031	3.04558	28.1563	2.19826
	Control	64	26.9375	3.26538	27.0000	3.13708
Form of the informative text	Experimental	64	7.1406	1.20669	7.2344	1.17841
	Control	64	7.4219	1.10991	7.3438	1.15770
Content of the informative text	Experimental	64	14.2344	2.59879	16.1406	1.82459
	Control	64	14.7344	3.13831	14.8438	2.66797
Style of the informative text	Experimental	64	4.8281	.70271	4.7813	.76571
	Control	64	4.7813	.62915	4.8125	.55990

Total score for the narrative texts	Experimental	64	26.2500	3.50962	28.8594	2.17392
	Control	64	27.4375	3.38003	27.6094	3.23482
Form of the narrative text	Experimental	64	7.4688	1.11225	7.4375	1.06719
	Control	64	7.5625	.99003	7.5781	1.02050
Content of the narrative text	Experimental	64	13.8750	2.89224	16.4219	1.92564
	Control	64	14.8750	3.13961	15.0156	2.60946
Style of the narrative text	Experimental	64	4.9063	.83035	5.0000	.73463
	Control	64	5.0000	.59094	5.0156	.65446

When the pre-test results of the students in the experimental and control groups were examined, it was found that the data had a normal distribution. Therefore, the independent groups' t-test was employed to determine whether there was a significant difference between the pre-test results of the experimental and control groups. The results of the test are shown in Table 5.

Table 5

Pre-test Independent Groups t-test Results of the Experimental-Control Groups

	t	*p*
Total score for the informative texts	-1.316	.191
Form of the informative text	-1.372	.172
Content of the informative text	-.982	.328
Style of the informative text	.398	.692
Total score for the narrative texts	-1.950	.053
Form of the narrative text	-.504	.615
Content of the narrative text	-1.944	.054
Style of the narrative text	-.736	.463

As can be seen in Table 5 the scores of the groups did not significantly differ for the following dimensions: total score for informative texts (t (126) = -1.316, p=0. 191), form of the informative texts (t (126) = -1.372, p=0.172), content of the informative texts (t (126) = -.982, p=0.328), style of the informative texts (t (126) = .398, p=0.692), total score for narrative texts (t (126) = -1,950, p=0. 053), form of the narrative texts (t (126) = -,504, p=0.615), content of the narrative texts (t (126) = -1.944, p=0.054) and style of the narrative texts (t (126) = -.736, p=0. 463). These findings show that there is no significant difference between the summarization scores of the two groups at the pre-test stage.

When the post-test results of the students in the experimental and control groups were examined, it was found that the data had a normal distribution. Therefore, the independent groups t-test was employed to determine whether there was a significant difference between the post-test results of the experimental and control groups. The results of the test are shown in Table 6.

Table 6

Post-test Independent Groups t-test Results of the Experimental-Control Groups

	t	*p*	Cohen *d*
Total score for the informative texts	2.415	.017	0.426
Form of the informative text	-.530	.597	-
Content of the informative text	3.210	.002	0.567
Style of the informative text	-.264	.793	-
Total score for the narrative texts	2.566	.011	0.453
Form of the narrative text	-.762	.448	-
Content of the narrative text	3.469	.001	0.613
Style of the narrative text	-.127	.899	-

Table 6 shows that in the following dimensions the experimental group had significantly higher scores: total score for informative texts (t (126) = 2.415, p=0.017), content of the informative texts (t (126) = 3.210, p=0.002), total score for narrative texts (t (126) = 2.566, p=0. 011) and content of the narrative texts (t (126) = 3.469, p=0. 001). However, the scores of the groups are found not to differ significantly in the following dimensions: the form of the informative texts (t (126) = -.530, p=0.597), style of the informative texts (t (126) = -.264, p=0.793), the form of the narrative texts (t (126) = -.762, p=0. 448) and style of the narrative texts (t (126) = -.127, p=0.899). The effect sizes were identified for the dimensions that were found to significantly differ between the groups. A weak effect size was found for the following: total score for the informative texts (0.426) and total score for the narrative texts (0.453. A medium effect size was found for the dimensions of the content of the informative text (0.567) and the content of the narrative text (0.613) (Cohen, 1988).

Table 7

Pre- and Post-Test Dependent Sample t-test Results of the Experimental Group

	t	*p*	Cohen *d*
Total score for the informative texts	-4.938	.000	0.632
Form of the informative text	-.800	.427	-
Content of the informative text	-5.221	.000	0.666
Style of the informative text	.536	.594	-
Total score for the narrative texts	-6.161	.000	0.814
Form of the narrative text	.306	.760	-
Content of the narrative text	-6.517	.000	0.838
Style of the narrative text	-1.000	.321	-

As can be seen in Table 7, the significant in-group differences in the experimental group are seen in the following: total score for the informative texts (t (126) = -4.938, p=0. 000), content of the informative text (t (126) = -5.221, p=0.000), total score for the narrative texts (t (126) = -6.161, p=0.000) and content of the narrative text (t (63) = -6.517, p=0.000). However, there was no significant difference

for the following dimensions: the form of the informative text (t (126) = -.800, p=0.427), style of the informative text (t (126) = .536, p=0.594), the form of the narrative text (t (126) = .306, p=0.760) and the style of the narrative text (t (126) =-1.000, p=0.321). For the dimensions which were found to significantly differ between the groups, the effect sizes were identified. There was a medium effect size for the total score for the informative texts (0.632) and content of the informative text (0.666). A strong effect size was found for the total score for the narrative text (0.814) and the content of the narrative text (0.838) (Cohen, 1988).

Table 8

Pre- and Post-Test Dependent Sample t-test Results of the Control Group

	t	***p***
Total score for the informative texts	-.201	.681
Form of the informative text	.671	.841
Content of the informative text	-.353	.504
Style of the informative text	-.341	.725
Total score for the narrative texts	.413	.735
Form of the narrative text	-.151	.721
Content of the narrative text	-.359	.880
Style of the narrative text	-.163	.871

Table 8 indicates that the control group do not have any difference in terms of the pre- and post-test scores in relation to the following: total score for the informative texts (t (63) = -.201, p=0.681), the form of the informative text (t (126) = .671, p=0.841), content of the informative text (t (126) = -.353, p=0.504), style of the informative text (t (126) = -.341, p=0.725), total score for the narrative texts (t (126) = .413, p=0.735), the form of the narrative text (t (126) = -.151, p=0.721), thecontent of the narrative text (t (126) = -.359, p=0.880), and style of the narrative text (t (126) = -.163, p=0.871). These findings show that there is no significant difference between the summation levels of the control group at the pre-test and post-test periods.

Table 9

Pretest and Posttest Dependent Sample t-test Results of the Experimental and Control Groups by Text Type

	Experimental group				**Control group**			
	Pret-test		**Post-test**		**Pret-test**		**Post-test**	
	t	*p*	t	*p*	t	*p*	t	*p*
Total score for the informative-narrative texts	-.101	.916	2.598	.012	-1.786	.079	-1.718	.091

In order to determine how the intervention made during the study differs based to the text type, the dependent sample t-test was employed, and the results are shown in Table 9. Table 9 indicates that there was no difference in the pre-test results of the experimental group based on the

text type (t (63) = -.101, p=0.916), but in the post-test results a significant difference was found in favor of the narrative text for the experimental group (t (63) = 2.598, p=0.012). In addition, there was no difference between the pre-test (t (63) = -1786, p=0.079) and post-test (t (63) =-1.718, p=0.091) summarization scores of the control group based on the text type.

DISCUSSION

The goal of this study is to look at how adding digital modes to printed texts makes multimodal texts and how that affects how well students can sum up what they read. Unlike previous studies, multimodal texts that combine physical and digital modes were preferred by using augmented reality technology instead of printed or digital multimodal texts. In the pre-test phase of the study, the experimental and control groups read and summarized the multimodal texts consisting of text and visuals in the printed textbooks. The results showed that there was no significant difference between the summarization scores of the two groups. When the post-test results were examined, it was found that there was a significant difference in favor of the experimental group in the total scores and content scores of the informative and narrative texts. On the other hand, it was found that the scores for the dimensions of the form in the informative text, the style in the informative text, form in the narrative text, and the style in the narrative text did not differ significantly between the groups. Also, the size of the effect was looked at for the dimensions that were found to be different in a significant way. A weak effect size was found for the total scores of informative and narrative texts, and a moderate effect size in the content scores of informative and narrative texts. When the results are evaluated in general, it is seen that students who read digitally supported multimodal print texts have higher summarization scores than students who read only print multimodal texts. Previous studies have also reported that these texts support the text comprehension of the students (Çetinkaya Özdemir & Akyol, 2021; Danaei et al., 2020; Tobar-Munoz et al., 2017). It is also found that the audio and video support provided in multimodal texts can contribute to student understanding (Cahyaningati & Lestari, 2018).

When the findings are analyzed, it is seen that there is no difference between the groups in terms of the form and style of both text types. The categories of form included"paper layout, number of paragraphs and grammar, punctuation, spelling errors". It is acceptable that the intervention does not have any impact on these topics. Because adding a digital mode to the text cannot be expected to affect the paper layout in the summaries written by the students. In addition, it is found that there is no significant difference in the stylistic dimension, which includes the headings of "use of tense suffixes, direct quotation or imitation". It was valid for both informative text and narrative text. In short, the findings did not differ by text type.

The current results show that multimodal texts prepared by adding digital modes to printed texts support summarization skills regardless of text type. In addition, it is found that the intervention made in the content dimension, which is the sub-dimension of summarizing and covers the titles of "meaning integrity, introductory sentence, plot, side thoughts, about details, use of keywords, a main idea", produced positive results. When the effect size of both text types in the content dimension is calculated in the pretest-posttest results of the experimental group, it is seen that there is a strong effect size. Therefore, it can be stated that the multimodal texts used in the study support comprehension, **as evidenced by** the increase in the scores which are related to the understanding of the text. Indeed, there is evidence that multimedia content supports the comprehension of texts (Kao et al., 2016). This situation can be explained by the activation of multiple senses with the digital mode

added to the printed text. Therefore, the text supported by audio and visual elements appeals to both reading and listening/watching skills. In some studies, it is reported that students who listen to the same text understand better than students who read it (Çetin, 2019; Çetin & Bulut, 2020; Yıldırım, Yıldız, Ateş & Rasinski, 2010). Based on these findings, it is possible to argue that listening skills may have supported the text comprehension.

Adding a digital mode to the printed texts may have contributed to the concretization of the elements in the text, thus supporting the student's understanding. In this context, considering the summaries written in the pre-test phase based on the Küçük Yunus text, it was found that some students explained the death of the dolphin by hitting a barrel. However, in the text, the main idea is about the chemical waste, and it is aimed to explain that the dolphin died due to- waste in the sea. Therefore, it can be stated that the students had difficulty in finding the main idea. In different studies, similar findings are reported arguing that students have difficulty finding the main idea of the texts (Kudret & Baydik, 2016). In order to reach the main idea, the text must first be understood and assimilated, and if it is implicitly given, the main idea should be understood from the details (Uysal & Pala, 2022; Yazıcı Okuyan & Gedikoğlu, 2011). It is found that a significant part of the students in the experimental group who misunderstood the message became more successful in the post-test phase. It is thought that the reason for this is the video support that highlights the sea pollution which is integrated into the text. Similarly, Boshrabadi and Biria (2014), who conducted-research on multimodal texts, stated that videos provide readers with an overview and background information about the content of the text. Therefore, all modes work together to reveal the meaning of the text to the readers (Svärdemo Åberg & Åkerfeldt, 2017) and contribute to the understanding process.

When the results are considered in the context of the text type, it is seen that there is no difference between the informative and narrative text types in the in-group pre-test evaluations. In addition, the post-test results of the control group also show that there is no difference between the summarization scores depending on the text type. Similar findings were also reported by Çetin (2019) who conducted a study on a sample of the 8th-gradestudents. However, the general agreement in the related studies is that the type of text affects the ability to summarize (Dilidüzgün, 2013). In some of the studies conducted with different sample groups, informative texts came to the fore (Karatay & Okur, 2012; Okur, 2011), while in others, narrative texts (Bulut, 2013) came to the fore. As a result of the intervention carried out in this study, a significant difference was found in favor of the narrative text summarization scores of the experimental group. Therefore, it can be said that although digitally supported multimodal print texts contribute to the students' summarizing scores for the informative texts, they contribute more to the summarizing of the narrative texts.

CONCLUSION and RECOMMENDATIONS

This study was done to find out how adding digital modes to printed texts makes multimodal texts and how that affects how well students can summarize. When the sub-dimensions of summarization were examined, it was seen that the intervention supported students in total and content scores, while it did not make a difference in form and style scores. Also, the developed texts helped students summarize both informative and narrative texts. However, they helped them more with narrative texts. So, it's best to do similar studies with large samples to make sure that the results can be applied to a wide range of situations. These studies should look at how developing texts using different digital modes affects the ability to summarize printed texts, collect in-depth qualitative data

to find out why multimodal texts are helpful, and add these texts to textbooks to help students learn how to summarize.

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Biographical notes:

Name and Surname of the Author: Bilal Şimşek is a research assistant at Akdeniz University. He completed his doctorate in the field of Turkish language education. His research interests include technology integration in education and Turkish language education.

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Research

The Walled Garden of Pedagogy: Leveraging Protection and Risk in Education

Nicola Robertson [1]

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Abstract:

This conceptual paper introduces the idea of the walled garden of pedagogy. I will come to delineate it as a desirable and necessary feature of education given that it offers a protective space for pedagogical practice and rehearsal. This paper critiques a previous conceptualisation of a walled garden introduced by unschooling advocate John Holt (in relation to the raising of children), in which such a metaphorical construction is described as a prison. The limitations of Holt's conceptualisation are used to then build upon the concepts of pedagogical reduction and Yves Chevallard's notion of "la transposition didactique" to argue that educators in practice inevitably build walled gardens from pedagogical foundations. It is argued, and thus recommended, that it is the gradual introduction of risk that separates the pedagogical walled garden from the conceptualisation of the childhood prison. It is imperative that educators understand their responsibility for leveraging the inevitable protective element and the necessary risk required in education.

Keywords: Pedagogical reduction, risk, protection, childhood

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[1] Teaching Fellow, University of Strathclyde, School of Education, Glasgow, UK. n.robertson@strath.ac.uk,
Orcid ID: 0000-0002-5356-1894

INTRODUCTION

In his work "Escape from Childhood" (1996), John Holt describes the "walled garden" of childhood. He conceptualises it as a place born out of a protective intent for our children, but with characteristics more fitting to a prison. His thought is that, without a gate or another means to leave, the walled garden is a space of over-protection, confinement, and stultification. It is, in short, not conducive to an environment that allows one to *grow* up as it does not allow for exploration beyond the wall. Our children, he suggests are treated as "fragile treasure[s]" (p. 4).

Given the educational concern inherent in ideas around how children should be raised, his "walled garden" metaphor is one which merits investigation by anyone with an interest in education. This paper is an attempt to dispel Holt's idea of the detrimental walled garden of childhood and, by extension, that adults are stultifying their experiences and subjecting them to future lives as sensitive souls unable to cope with the inevitability that other people think differently to them. I refer to both Holt's text and to the work of the sociologist Frank Furedi as they come to represent some of the most vocal advocates against ideas of modern parenting and conceptions of childhood. I then take Holt's concept but transpose it onto the pedagogical. I suggest that pedagogy itself builds a walled garden for students. I use the concepts of pedagogical reduction (Lewin, 2018) and *la transposition didactique* (didactic transposition) as espoused by Chevallard (2007) to examine the essential role of the walled garden in pedagogy and whether it bears any resemblance to Holt's conceptualisation of a prisonlike environment with no escape. I will then come to show that introducing risk into the pedagogical walled garden is not only desirable but necessary, and it is this that distinguishes the garden from the prison. Let us begin by looking at Holt's walled garden in a little more detail.

HOLT'S WALLED GARDEN OF CHILDHOOD

"Most people who believe in the institution of childhood as we know it see it as a kind of *walled garden* in which children, being small and weak, are protected from the harshness of the world outside until they become strong and clever enough to cope with it. Some children experience childhood in just that way. I do not want to destroy their garden or kick them out of it. If they like it, by all means let them stay in it. But I believe that most young people, and at earlier and earlier ages, begin to experience childhood not as a garden but as a *prison*." (Holt, 1996, p.5, emphasis added)

From the very outset, Holt's self published work "Escape from Childhood" takes a scathing look at the institution of childhood, a social construct aimed at separating children from the adult domain, with Holt styling himself as the arbiter of children's rights. Since this is a work published by Holt's own foundation, it is not unfair to be sceptical about whether its inclusion is merited in an academic work such as this. In this regard, I agree with Dickerson (2019) that Holt's work – however conceived and communicated –

represents a rich critique of a modern educational endeavour that, in my observation, has changed little since his original writing in the 1970s. As a former educator himself, Holt was in an optimal position to make such a critique. Furthermore, it is pertinent to note that the original publication of this book in 1974 predates the United Nations Convention on the Rights of the Child by 15 years (UNICEF UK, n.d.), but that some of the rights Holt describes do match the articles as set out by the UN much later. Of course, we cannot say for sure that his ideas were at all influential in the drawing up of the UNCRC but, in some sense, he very accurately predicted the legislative turn towards children's rights. That being said, I suspect he would be likely to disagree with this Convention insofar as it seeks to preserve the idea of childhood he aims to deride. Certainly, the UN's categorisation of a child as "every human being under the age of 18 years" (UNICEF UK, n.d., p.3) would be a particular sticking point.

In Holt's conceptualization of childhood, there is no immediate shift to adulthood at the age of 18 (or any age). He is not the first to wonder when a child somehow crosses the invisible line to adulthood. Hannah Arendt (1961) was similarly perplexed, and Froebel (1886) before her noted that we could not categorize maturity via age. Nevertheless, none deny that such a change is made – just that it cannot be pinpointed. So, Holt affirms, "We do not… suddenly turn from one kind of creature into another that is very different "(1996, p.4) and it is this imaginary division of life into two discrete parts – Childhood and Adulthood – which has contributed to the break in the continuous growth of the "curve of life". No longer is childhood the inevitable phase of dependency graduating towards maturity, distinguished by Holt as a "fact" of childhood; now there is a chasm between the world of the adults (and the wider society) and the world of the children, where he argues that children are treated as "a mixture of expensive nuisance, fragile treasure, slave and super-pet" (p.4). This separation is what characterizes the institution of childhood for Holt, and the walled garden is its most astute symbol.

What can be connoted from the ideas of the walled garden and the institution, and indeed the prison, is confinement. The institution of childhood has been built to keep children out of the adult world and inside their own. Similarly, the walled garden according to Holt has been built not only to separate children from the sphere of adults, but furthermore to protect them from the harshness they may encounter in it. He suggests that in order to remove the stultifying element (I invoke Rancière's (1991) description of stultification as acting with the assumption that the parent/educator is more intelligent and, thus, knows better) one must put a gate into the garden to allow children to visit the potentially dangerous world outside if they wish.

However, we must not think of the walled garden of childhood as a vanilla paradise to be escaped from in order to experience risk. Holt describes it as a rather unpleasant place for both parents and children. Parents resent building and maintaining this sacrosanct place while not being able to stay in it themselves due to responsibilities on the outside. With simmering resentment masquerading as pedagogical effort, they begin to introduce

exaggeratedly undesirable representations of the world outside to help their children prepare for the barren reality of adulthood. Those readers of a certain age and from the UK may remember such child safety campaigns as "Stranger Danger" in which young children are warned of the terrible dangers posed by people they do not know; this could be characterized as one of Holt's undesirable representations. He paints an equally miserable picture for children. He tells us that a "Happy, Safe, Protected, Innocent Childhood, does not exist for many children." (p.5) and so, the enterprise of building the walled garden as a means of protecting these already vulnerable children seems futile in the first place. Furthermore, he seems to suggest that Happiness, Safety, Protection, and Innocence are almost ideal states of childhood (his use of capitalisation assigns them a level of importance) while, at the same time, suggesting that children should have the right to relinquish all of these things. Such observations on the quality of "childhood" for some children seem to have been born from Holt's time as a teacher in the US, and so we should be mindful that they are contextually narrow.

Almost 30 years after the initial publication of Holt's book, sociologist Frank Furedi published his own thesis, Paranoid Parenting (2002), in which he takes the notion of the walled garden further still. While he never uses the phrase explicitly, he describes a situation in which parents feel under increasing pressure to not only protect children from the outside world, but to stimulate, educate and dedicate all of their time to their children. Now, the walls are not just built as a makeshift shelter from the trials of adulthood by parents in the way that Holt describes, but childhood becomes a superstructure, reinforced, and galvanised by the words of expert advice. Not only is Furedi's conceptualization of the walled garden an impenetrable fortress for the child, but also parenting itself has become an ordeal as they attempt to maintain the structural integrity – so ordered by child rearing experts - of that same fortress. Furedi's conceptualization of the walled garden is endemic of extreme parental insecurity and wanting to keep children close as their parents see them as central to their own dwindling identity. In Furedi's time, it is as much about protecting the parents' fragility as it is about protecting that of the child.

All of this comes to construct childhood as an inherently difficult time for both children and parents, and imagines children as thoroughly innocent, vulnerable, and fragile. Vulnerability is not necessarily the child's default state, however. Corteen and Scraton (1997), while specifically discussing sexuality in childhood, note that it is an inevitable result of protecting a child's innocence that their experiences and competencies are therefore neglected. Adults come to determine everything about a child's "behaviour, choices, opportunities and potential" (p.99), and it is the denial of this independent agency that causes children to become vulnerable. The protective influence of the walled garden is, in fact, what comes to fabricate a child's vulnerability as well as perpetuating it; it is performative.

One can only imagine what manner of adult rises from such a childhood. Holt never openly speculates, but we can extrapolate from his thinking that he suspects an adult raised

within the confines of the garden prison is one ill-equipped to deal with the realities of adulthood. I find it an interesting irony in his work that, given his conceptualisation of adulthood as a gradual curve from childhood, he never wonders what a child bestowed with a gate in their garden might become: will they be "better" people for venturing outside of the garden? Happier, maybe?

Furedi (2002) urges caution when attempting to predict what kind of adult a child might become, lest we fall into the trap of "infant determinism" – that is to say that all adult behavior can be based (blamed) on how we experience life during childhood. Still, he admits the parental role of socialization is an important one, but parents themselves are so confused about what it means to be an adult that they are not sure whether they are cultivating "mature adults, uncertain adults, or adults who would like to go back to being children" (p.131). If the walled garden is created by adults struggling to understand what it is to be an "adult", and these people are apprehensive to let their children out, then of course these parents are socializing future generations into a psychic state of confusion.

To summarise, we might conceptualize the walled garden of childhood as a prison built by parents to keep their child in, and the world out. Parents, full of both resentment at their responsibility for their children, and reluctance at letting them go due to their reliance on them to fortify their sense of identity, re-present the world to their children by showing them select features of it in order to manipulate the child into feeling fearful of what lies beyond. Children are socialized into becoming inept adults because they are not equipped to deal with life outside of their garden, with all of its potential for hurt and disruption. If we accept Holt's (and consequently Furedi's) views on childhood and parenting, generations of oversensitive people incapable of living as adults – as blurry a concept as this is - seems inevitable.

THE PEDAGOGICAL WALLED GARDEN

Of course, it is not imperative that we accept their views, especially given that they are fraught with some questionable assertions. For example, Holt regularly makes semantic distinctions between child and adult while not being entirely clear on the exact categorical distinction. If children gradually become adults at no set age, with no clear change, what is the criteria for describing a person as either an "adult" or a "child"? Furthermore, invoking the ideas of Furedi, if parenting is such an ordeal, would not emotionally immature parents rather run in the opposite direction than keep their children close? In any case, these ideas of the figurative walled garden of childhood constitute a thinly veiled critique of the overprotective model of modern parenting. In this section, I will set out my conceptualization of the pedagogical walled garden with a view to determining whether it bears any resemblance to Holt's conceptualization of childhood prison.

It is important, first of all, to make a distinction between parenting and pedagogy[2]. While there may be similarities between them, it is fair to say that these are conceptually different (van Manen, 1991). To move away from the somewhat derogatory interpretation of parents given by Holt and Furedi, I take this description of the aim of parenting from Hoghughi (2004):

> the most and the best parents can do for their children is to give them a core of unconditional love and reliable care, providing a safe setting for children's own resilience and developmental potential to unfold
>
> (p.5)

This aim sets parenting apart from parent as a status bestowed upon a person who has simply participated in the process of procreation. It no doubt feeds into contemporary normative assumptions of what it is to be a "good" parent which could be problematic, certainly when it comes to the idea of unconditional love – a concept that cannot be succinctly defined here. For the purposes of distinguishing parenting from pedagogy, I take the stance that parenting is any action taken by an adult towards a child which aims somewhat towards Hoghuhi's description of parenting. A "parent", rather than a biological producer of children, is any person who carries out such action with this goal in mind. Such actions will differ across cultural contexts, times, and individuals; for example, it may be culturally acceptable to use corporal punishment to discipline a child in certain parts of the world, as it certainly was in the UK in centuries past. This punishment may be given with no less love, and in a similar context of reliable care, as the parent who chooses a different route.

Pedagogy, on the other hand, I define as the setting of conditions which offer the student the opportunity to effect a change in how they relate to themselves and the world around them. There is something of a crossover here, perhaps – parenting creates the conditions of love and care and safety required to allow the child to develop (development being essentially a change). As a central feature of education, however, pedagogy has the educational intention woven into it: the intention to instigate a desirable change in a student's relation to something internal, or external, to them. The intention to invoke a change in the student is the distinction here. Parents might certainly create these conditions, but they do not always do so with the intention to change their child's relation to something. For example, a loving and caring environment might be the optimum place for a child to start walking and talking, but the environment is not necessarily created with this end goal in mind.

[2] It is important to note that while I have focussed on children here in order to make the cleanest comparison with Holt, pedagogy does not exclusively refer to children. Any student, of any age, in any situation can be found within the walls of the pedagogical garden.

So, to the garden itself. Like Holt's garden, the pedagogical walled garden is fabricated by someone other than the child (or student). It emphasises a power differential between the educator and the student which parallels that of the parent and child – one is building for the other. Neither are the intentions for building entirely different. Protection features in both parenting, as we have seen, and pedagogy. Mollenhauer (2013) describes it as a kind of "safety zone that protects children and teenagers from feeling the full weight of life in society" (p.49). Here, he in fact connects the familial and educational domains as he describes them both in terms of "shielding and filtering" elements of the world outside either domain. Conceptually, there is little difference in the walled gardens of childhood and pedagogy in terms of intention – they are both built with the aim of protection at their core.

Moreover, each of the two gardens is optimally constructed to separate itself from what lies beyond. They share the characteristic of being a suspension of the reality of life beyond its walls. Holt may baulk at the idea that children should ever be subjected to such a thing, but in terms of pedagogy this suspension occurs routinely on both a macro and micro scale. Take the macro example of the school, for instance. In a very literal sense, school premises are gated, fenced, or walled off creating a barrier between the happenings inside the school, and what is going on outside: "society is in some way kept outside – the classroom door shuts and the teacher calls for silence and attention." (Masschelein and Simons, 2013, p.38). These walls, however, are not an effort to confine but, as Masschelein and Simons further suggest, are (paradoxically) essential for a student to gain the freedom of space and time required to focus their attention on a particular subject – the subject itself also suspended from society.

Yves Chevallard (2007) describes this suspension as *la noosphère*: a buffer zone between the *savoir savant* (accepted knowledge) held within the highly complex structures of society, and the *savoir à enseigner* (content-to-be-taught) offered up to students. The educator is the mediator between *la noosphère* and their students. While it is society that decides what is culturally valuable to teach its students (Gauvin and Boivin, 2012), it is the teacher who proceeds to take this knowledge and carry out the process of didactic transposition (*la transposition didactique*) which, in its initial stages, first removes the knowledge from the context of its original production. Knowledge in its original context, suggests Chevallard, gets worn down by use in society. In order for the accepted knowledge to become content-to-be-taught, it must be removed from its productive function in society –a sentiment which would be later echoed by Masschelein and Simons (2013). Thus, the educator decides what is brought into *la noosphère* and how. It would seem the educator both fashions the walls of the pedagogical garden and carefully curates for its inhabitants.

Chevallard's example of the shift of knowledge from its original context into *la noosphère* constitutes what he considers an external transformation. The object of knowledge then goes through a second transformation – an internal transformation – from content-to-be-taught to content-actually-taught. It is here that the micro perspective comes into focus:

with the walls of the garden now built and the contents (a suspension of "real life") now within, the educator has to do *something* to make this content capable of being taught. Chevallard gives an example of the distinction of the curriculum text which defines the content-to-be-taught, but it is the effort of the educator who interprets this text and transforms the words on the paper. It is the educator who applies it to relationships with actual students, and creates lessons, activities and examples based on their interpretation of such a text.

The act of suspending an object of knowledge from its original sphere; the idea that it is brought into a protective environment where the educator offers their interpretation of how this is best to be offered up to students leads us on to the concept of pedagogical reduction. (A) Pedagogical reduction can be considered both the process of selecting, simplifying, and re-presenting something from "real life" to students, and the result of such a process (Lewin, 2018). First, the educator selects what they judge to be valuable to show their student(s). In doing so, the educator inevitably obscures everything else that they deem unnecessary. The proverbial walls of the garden are built here. Next, the educator will simplify the content for the student. This does not necessarily mean a simple dumbing down. As Wagenschein (1999) suggests it is more the creation of an appropriate entry point for students to begin. This can be the removal of complexity in some cases, or the addition of supports in another. For example, Lewin gives the example of the balance bike which removes certain elements of the bike's mechanics (pedals and brakes) in order to cultivate the requisite balance required for the child to ride a "full" bicycle. However, as I contest, a child may also learn using a bicycle with stabilisers, where nothing material has been removed but supports have been added. These are intended to cultivate the same requisite balance to allow the child to eventually ride a bicycle without them. Both have an educational aim in mind, but also a protective aim to prevent the child from falling and injuring themselves. Thus, simplifying in pedagogical reduction is not always about removing or making less complex – anyone who has ever fitted a child's bicycle with stabilisers will attest to this. Nevertheless, it can still justifiably be considered a simplification since it removes something from the overall activity. In this case, it removes the child's need to balance.

The final step in the reduction process is re-presentation. After content has gone through the selection and simplification stages, it is no longer the same as it was at the outset. The result is "a facsimile or reproduction of the world… that is "better", for the sake of the children." (Mollenhauer, 2013, 53). What exactly is "better" about it? Mollenhauer suggests that the facsimile removes everything that is intolerable or difficult about the world. In this sense, the reproduction becomes "better" than the original. This is logical, given that the adults are choosing the most valuable things to re-present, removing them from the sphere of productivity and endowing them with a pedagogical shield which, as Masschelein and Simons (2013) alluded to above, offers a paradoxical kind of freedom to fully engage with them in "pedagogical rehearsal or practice" (Mollenhauer, 2013, p.31).

The walled garden of pedagogy, then is a safe place. Whether characterised as a buffer zone between society and student as in *la noosphère*, or a place/thing for pedagogical practice as in the result of pedagogical reduction, we can conclude that pedagogy itself, at least as it is viewed through the lenses of *la transposition didactique* and pedagogical reduction, can only work in the highly manufactured, stylised environment of the walled garden. This is due to their instrumental role in the constructing and curating of these gardens. Unlike the walled garden of childhood, where Holt and Furedi suggest that parents want their children to stay weak and vulnerable forever, the pedagogical garden is a place which wants its inhabitants to change. Thus, there is no need to build a gate to allow a child to escape; the students build their own gates when they are ready. With walls that allow for suspension from "real life" and carefully curated contents held within, the pedagogical walled garden begins to resemble the timeless paradises such as those to be found within the hallowed grounds of New College, Oxford, or the regal setting of Culzean Castle in Ayrshire, UK.

Now a question arises: one person's paradise might be considered another's prison. The intentions behind the building of the pedagogical and the childhood gardens might be different, but surely any practice which obscures the world from the child/student is problematic? Does the possibility not remain that even pedagogy could have a detrimental impact on how a child develops into an adult if they are consistently subject to the obfuscations of the educator? Would this not result in stultification or epistemic injustice? (Fricker, 2007).

Not necessarily – and the answer to this lies in the introduction of risk.

INTRODUCING RISK

In order to rally against the childhood prison, Holt tells us a child must escape into the outside world to be able to experience any kind of risk. On the importance of taking risks – in education, in life – Holt and I agree, but not necessarily on the methods by which children can experience these risks. In the pedagogical walled garden, risk must be introduced as the student continues on their journey of changing relations. This idea of risk is not to be confused with Holt's description of parents introducing representations of dangers from the "outside" as a deterrent for venturing away from perceived safety.

One might be inclined to separate risk into discrete categories such as physical (risk of injury) and intellectual (risk of discomfort). While this would be entirely possible, and indeed an attractive prospect, I intend to cover risk as a systematic notion taking Solomon's (2014) definition of risk as any action with an unclear outcome.

With this idea in mind, Biesta (2013) might contrarily find Holt's method of yielding complete freedom to a child in fact characteristic of a risk-free education. Education, he posits, is not about giving a child/student complete freedom or placing them under total control. It is not even about trying to find a middle ground between these two extremes. It is, as I have outlined above, about making a desirable change in a student's relation to

something. Thus, the overriding risk in education, which Biesta outlines in his work, is the human element. He describes students as subjects of action and responsibility which, try as an educator might, can never be predictably moulded or manipulated. Walling a child/student into a particular situation or environment may preclude the limits of what they can experience, but it cannot predict their reaction to it. This overriding risk further separates pedagogy from Holt's notion of a childhood prison.

In terms of material risk rather than a philosophical one, being as it is a safe place for pedagogical practice and rehearsal, it seems illogical to suggest that everything within the pedagogical garden should be instantly achievable and straightforward. Of course, this would then render the need for practice or rehearsal as entirely moot. As curators of the pedagogical walled garden, it is up to the educator, in interaction with the student, to decide how much risk – beyond the inherent risk already present in the educational situation - a child can be subjected to and at what point.

Closely related to ideas of risk are feelings of fear. Pain (2006) tells us that fear of parents for their children does not match the fear that children have for themselves. If, as I suggested earlier, parents are instrumental in perpetuating the vulnerability of their children, then it is justifiable that they would be fearful for these fragile creatures and do all they can to protect them. Indeed, it could be cynically suggested that a cycle ensues where fear begets protection which, in turn, perpetuates the vulnerability which causes parents to be fearful. In a sentiment that is curiously analogous to Holt and Furedi, some interpretations of Janusz Korsczak's call for children to have the right to die believe that this puts impetus on parents to allay their selfish fears so as not to inhibit exploration and imagination (Walczak, 2018).

With this firmly in mind, there is room for fear in pedagogy. Imagine the student assigned the task of speaking in front of their class who is reluctant given their fear of speaking publicly. This fear is born from the student's perceived risk that they could make a mistake, or become a laughing stock, or that no one will be interested in what they have to say. A protective parent's instinct might be to take their child away from this situation to relieve their feelings of anxiety. An educator, on the other hand, would be keen to see them complete this task in the hope that the student's feelings about public speaking might change. The path of education is not necessarily one that runs smoothly. The hypothetical prisoners in Plato's cave, once freed from their fetters, experienced a great deal of pain throughout their enlightened ascension to the world beyond the cave (Plato, 1963). Similarly, a pedagogy of discomfort invites students to leave behind what they know to be familiar and take a risk to experience something alien to them (Zembylas & Boler, 2002). Indeed, if pedagogy creates the conditions intended to instigate a change, the student must submit to taking a step into the unknown – this is always a risk.

An important strategy here is not to discount the child's thoughts and experiences as immaterial in the decision to introduce risk. Holt and Furedi describe situations where

parents routinely ignore the child's feelings and implement their own protective faculties as it is assumed that children do not have the capacity to assess risk effectively. This could be considered a kind of self-fulfilling prophecy: if a child is not allowed to experience anything that is risky, how can they be expected to either identify or assess risk? In Germany, introducing children to risk is a very public endeavour. Playgrounds are built with extra high climbing towers, wobbly suspension bridges and lopsided steps; the aim is to promote the optimum level of freedom for exploration while not *entirely* sacrificing safety – but understanding that every possible accident cannot be prevented (Olterman, 2021). Solomon (2014) offers more examples throughout history of playgrounds that may have inspired this shift to risky play in Germany.

There is no better metaphor for the pedagogical walled garden than these playgrounds – a place of relative safety with risk built in to allow for exploration of what lies within the walls. Pedagogy then comes with an inherent risk (à la Biesta) and an acquired risk (so perceived by the educator and student). There is room for practice in the risky endeavour (Smith, 1998) which reflects the room for practice offered in pedagogical reduction which exemplifies the notion of education as risky in and of itself. Holt's childhood walled garden can be conceptualized as a prison because you are either locked in it or escaping from it. The pedagogical walled garden can be truly thought of as a garden because having risk built into it, alongside everything else curated by the educator, really does allow for growth, arguably unique from that which lies outside of its walls.

CONCLUSION

The walled garden of childhood is presented to us by Holt as a miserable place, from which many children seek an escape. It is fashioned by overprotective, resentful, insecure parents who, with strangely converse reasoning, wish to keep their children close to them. The walled garden of pedagogy, on the other hand, is a suspension of society. It offers a space for pedagogical practice, while shielding students from the pressures of being productive members of society: they can study English and write essays without the pressure of having to submit their work for publication, for example. Any attempts at entirely removing the walls of the pedagogical garden would result in whatever the educator is attempting to achieve to be no longer pedagogical: it would be work.

The discourse on risk, parenting and childhood is large and diverse. I have focussed on Holt and Furedi in this paper as they represent somewhat extreme positions on the subject. A more nuanced position could be found in future for anyone wishing to carry on the baton of what I have introduced here. The breadth of discourse is similarly wide when it comes to pedagogy; less so when it comes to pedagogical reduction (certainly in English).

While one might argue that any space which places a wall around children/students could be conceptualised as a prison, as Holt does, it is in the inclusion of risk in the pedagogical walled garden which resists it becoming a place of stultification. It is not

something to be resisted: for education to succeed, the student must submit to inhabiting the garden – at least until they are ready to build the gate to leave.

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Biographical notes:

Nicola Robertson: Nicola Robertson has a PhD in Education from the University of Strathclyde, Glasgow. Her research interests include philosophy, technology, and popular culture and education.

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Research

Investigating Preservice Teachers' Self-Efficacy and Motivation to Teach English Language Learners (ELLs) [1]

Reem Ibrahim [2]

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Abstract:

This study investigated preservice teachers' self-efficacy and attitude in working with ELLs in Arkansas. The investigator employed a within-subject design to examine the interrelationships among social cognitive variables (self-efficacy, motivation, and teachers' preparation programs) and their role in predicting preservice teachers' confidence to teach ELLs in their future classrooms. The main finding of this study is that preservice teachers who are attending educational programs have high-levels of motivation and self-efficacy to work with ELLs in Arkansas. Furthermore, the results of this study revealed that preservice teachers show a strong and positive correlation between their level of confidence to engage ELLs in class activities, to create instructional strategies tailored for ELLs, and to manage ELLs classroom environment. Finally, the results of this study found that speaking a second-language and the level of intrinsic motivation are significant predictors of preservice teachers' self-efficacy to work with ELLs in their future classrooms. In general, these results are consistent with previous findings produced in the context of preservice and in-service teachers.

Keywords: Preservice teachers, self-efficacy, motivation, English Language Learners (ELLs)

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[2] Reem Ibrahim M.A., Arkansas Tech University, College of English and World Languages, United States. ribrahim@atu.edu
https://orcid.org/0000-0002-3381-0435

INTRODUCTION

Over the past 30 years, research has shown that the population of students in the United States has become increasingly linguistically and culturally diverse (Lee & Buxton, 2013; Villegas et al., 2018). The increased number of English Language Learners (ELLs) stems from a boom of immigrant families moving to the South, drawn to jobs in construction, agriculture, and food-processing industries. Consequently, the number of ELLs in PreK-12 schools is one of the fastest-growing student populations in the United States, with over 5.1 million students enrolled in public-school systems in fall 2019 (10.4 percent increase from 9.2 percent in fall 2010), with a predicted increase to 40% by 2030 (Statistics, 2022). This figure represents a demographic shift in the U.S. which indicates that the number of ELLs enrolling in schools will continue to increase.

Out of the fifty states, the state of Arkansas ranked as one of the top five states, with the highest ELL growth rate of 102% (Carnock, 2017). In the 2021 academic year, Arkansas public schools enrolled 39,155 ELL students, or 8.3% of the total student population and 7% in open-enrollment public charter schools. Approximately 18% of ELLs were also in special education. To prepare teachers, the state of Arkansas utilizes certification requirements for ELL instructors, and the Commission on Teacher Credentialing issues authorizations for teachers providing services to ELLs. This credentialling includes authorizations for teachers providing specially designed content instruction delivered in English, content instruction delivered primarily in the primary language, and instruction for English-language development.

Research has shown that several factors can contribute to teachers' success in their classrooms, such as training programs, motivation, the teacher's characteristics, and self-efficacy (Klassen & Chiu, 2011). Unfortunately, research has indicated that mainstream teachers feel unprepared to work with ELLs, and teachers report feeling less confident working with ELLs than with other student populations (Durgunoglu & Hughes, 2010; Siwatu, 2011). For example, many teachers working with ELLs do not believe that they are adequately prepared to meet students' learning needs, particularly in academically demanding subjects such as science (Janzen, 2008). This sense of teachers' low levels of efficacy often results from lack of experience and knowledge of how to address the complex educational needs of ELLs (Lee, 2005; Lee & Buxton, 2013).

Additionally, researchers have questioned whether teachers are prepared to effectively address the needs of a culturally diverse population within classroom settings and environments (Heafner & Plaisance, 2016). Low levels of efficacy mean that preservice teachers will be less likely to focus on ELLs and provide them with the high-quality instruction necessary to reach academic success (Washburn, 2008). Without an increase in preservice teachers' efficacy for teaching ELLs, future teachers will not be able to properly meet the needs of higher enrollments of ELLs in schools and may view students' first

languages as barriers when working with ELLs (Torres & Tackett, 2016; Wall, 2017). Therefore, finding prepared and confident teachers to design effective instructional models suited for ELLs is among a variety of difficulties in many of the nation's public schools, especially in the highly ELL-populated cities.

Researchers have considered that teachers' self-efficacy is one of the essential factors that impacts their performance in the classroom; therefore, is receiving growing attention in educational research (e.g., Pas et al., 2012; Skaalvik & Skaalvik, 2007; Soodak & Podell, 1996; Wheatley, 2005; Zee & Koomen, 2016). For example, studies have found that teachers' sense of self-efficacy has a major influence on how they approach challenges in the classroom (Klassen & Chiu, 2010; Klassen, Tze, et al., 2011; Künsting et al., 2016). Similarly, many studies have concluded that teachers with high levels of efficacy for teaching tend to utilize a variety of instructional strategies and good educational practices that are positive for students' engagement and achievement outcomes, even when faced with challenging situations (e.g., Fives & Alexander, 2004; Heneman III et al., 2006; Lin et al., 2002; Skaalvik & Skaalvik, 2007).

Furthermore, many researchers indicate that individuals' self-efficacy is associated with their positive attitudes and closely linked to their self-regulated learning skills, where individuals with stronger self-efficacy perception are more likely to plan, monitor, and regulate their work (Bong & Skaalvik, 2003; Linnenbrink & Pintrich, 2003; Pintrich, 2004; Savolainen et al., 2012; Savolainen et al., 2022; Seifert, 2004; Yada et al., 2018). Thus, an individual's self-efficacy has strong influence on a teacher's behavior and is related to a wide range of instructional variables and learning outcomes (Lackaye & Margalit, 2006; Pajares, 1996; Tschannen-Moran et al., 1998).

Many researchers consider social cognitive theory one of the major theories that discuss the self-efficacy construct. Bandura (1986) identified self-efficacy as a method of self-judgment that influences decisions about what behaviors to undertake, the amount of effort and persistence put forth when faced with obstacles, and finally, the proficiency in the behavior. Further, individuals' self-efficacy reflects what they believe they can accomplish with the knowledge they have mastered during their learning, and it does not refer to a person's skill at performing specific learning-related tasks. Therefore, self-efficacy assesses individuals' judgment of their ability to apply knowledge and skills in a broader context.

Although much attention has been directed to the efficacy beliefs of preservice teachers and their correlation with teaching/learning behaviors in the classroom (Milner & Hoy, 2003), examining preservice teachers' self-efficacy and attitude towards working with ELLs in Arkansas has received little attention in the literature. Therefore, the purpose of this study is to investigate preservice teachers' self-efficacy and attitude in working with second-language learners in Arkansas.

Literature Review

Research has explored factors affecting preservice teachers' self-efficacy and attitude towards teaching English to ELLs. Although the literature covers a wide variety of such discussions, this review will focus on five major themes which emerge repeatedly throughout the literature. The themes this literature review will discuss are teachers' self-efficacy and motivation, teachers' self-efficacy and attitudes, teachers' beliefs in language teaching, teachers' misconceptions regarding teaching ELLs, and teacher-preparation programs.

Teachers' Self-Efficacy and Motivation

Self-efficacy is grounded in the theoretical framework of social-cognitive theory that underscores the evolution and exercise of human agency over what they do through being self-organizing, proactive, self-regulating, and self-reflecting (Bandura, 2006). Researchers have identified teachers' self-efficacy as the measure of teachers' belief about their preparedness to teach and to help students achieve educational goals. Many scholars have attested that teacher self-efficacy plays a significant role in students' success in the classroom (Hoy, 2000; Jerald, 2007). Other scholars have described teachers' self-efficacy as the educators' confidence in their own skills to achieve classroom outcomes. In general terms, teacher self-efficacy refers to the teacher's belief in employing his or her abilities to bring about valued outcomes of engagement and learning among students, including difficult and unmotivated students (see Bandura, 1977; Tschannen-Moran et al., 1998). Therefore, teachers' beliefs may impact ELLs academic outcomes due to their use of different teaching strategies and accommodations they implement in classroom instructions (Lauermann & Karabenick, 2013).

Bandura (1986) defined self-efficacy and confidence as two distinct constructs. Self-efficacy refers to an individual's belief in their ability to perform a particular task or achieve a specific goal successfully. It is the perception of one's capability to carry out a specific action successfully in a particular situation. On the other hand, confidence refers to an individual's overall belief in themselves, their abilities, and their potential to succeed in various situations. Although, confidence is a more general construct than self-efficacy and is not necessarily task-specific, a person may be confident in their abilities overall, but they may not necessarily have high self-efficacy in a specific task or situation.

Much research has also found that teachers with a high sense of self-efficacy are more enthusiastic in teaching (Allinder, 1994; Guskey, 1984), more committed to teaching (Coladarci, 1992; Evans & Tribble, 1986; Trentham et al., 1985), and more likely to stay in teaching (Glickman & Tamashiro, 1982). Bandura and Adams (1977) argue that people with higher levels of self-efficacy beliefs are more prepared to teach. Researchers have indicated that preservice teachers' self-efficacy has an influence on whether the teaching methods and the educators' knowledge would be successful or unsuccessful. Moreover, scholars have

demonstrated that preservice teachers have better levels of self-efficacy compared with in-service teachers (Benz et al., 1992; de la Torre Cruz & Arias, 2007; Fives et al., 2007; Woolfolk & Hoy, 1990). Research has found that the inability of some in-service teachers to teach ELLs may stem from teachers' lack of cultural competencies, understanding of second-language acquisition, or comprehension of the language-learning process that confronts ELLs (Bull et al., 2012; Harris & Jones, 2010; Hoover, 2012; Wall, 2017).

Self-efficacy theory posits that students who believe themselves to be capable are more likely to be motivated; those who believe themselves incapable will not be motivated (Seifert, 2004). Much research shows that self-efficacy influences academic motivation and learning achievement (Pajares, 1996; Schunk, 1995). Therefore, teachers' motivation is an important concept related to their performance and persistence in their profession. Educational research has given special attention to preservice teachers' motivation due to its impact on teachers' self-efficacy and the teaching environment (Klassen, Al-Dhafri, et al., 2011; Tschannen-Moran & Hoy, 2001). Researchers have argued that preservice teachers who are intrinsically motivated are more likely to have better teaching performance, which would reflect on students to develop more interest in learning (Klassen, Tze, et al., 2011; Malmberg, 2006; Reeve et al., 1999; Roth et al., 2007; Wild et al., 1997).

Teachers' Self-Efficacy and Attitudes Towards ELLs

Many researchers have examined the relationship between teachers' self-efficacy and their attitudes and found inconsistent results (e.g., Chan, 2016; Drysdale et al., 2017). While a considerable number of studies have reported strong and positive correlations between teachers' self-efficacy and their attitudes, other studies reported weak or insignificant relationships between these two constructs. For example, some studies found that there is a strong and positive relationship between teachers' self-efficacy and their attitudes towards ELLs (Karabenick & Noda, 2004). Conversely, other studies found weak or no conclusive evidence on the causal relationship between teachers' self-efficacy and their attitudes (Chan, 2016; Drysdale et al., 2017; Durgunoglu & Hughes, 2010).

Teachers' Beliefs in Language Teaching

Scholars have identified teachers' beliefs as a set of ideals that teachers hold true regarding teaching, students, learning environment, and educational concepts. Research has described teachers' beliefs as "drive" that helps shape their teaching and interaction with students. For example, teachers' beliefs have been found to influence teachers' behavior in the classroom, govern their lesson planning, guide learner development, lead their curricular priorities, control their decision-making process, and manage their interactions with their learners (Farrell & Ives, 2015; Gilakjani & Sabouri, 2017; Kuzborska, 2011; Molle, 2013).

Research highlights the importance of teachers' beliefs on their teaching, such as guiding and informing teachers' thoughts and behaviors and shaping the foundation for their actions in their classrooms (e.g., Calderhead, 1996). Further, researchers have found

that teachers' beliefs may have an impact on the students' behavior and learning outcomes (Mantero & McVicker, 2006; Rueda & Garcia, 1996). Similarly, researchers have found that teacher beliefs have a profound impact on their opinion regarding teaching culturally diverse students. For example, researchers found that teachers would judge students' learning abilities based on their own perceptions, which may result in negative opinions regarding students who are from culturally diverse countries (Lucas et al., 2008). While many studies have shown that teachers generally have expressed encouraging opinions about teaching culturally diverse students, other studies found that some teachers were hesitant to teach ELLs and that teachers who speak one language are more likely to have deficit- based beliefs towards ELLs (e.g., Byrnes & Kiger, 1994; Byrnes et al., 1997; Garmon, 2005; Hadaway, 1993; Pettit, 2011). However, other researchers have indicated that, although teacher beliefs are associated with their behavior in the teaching environment, they do not guide their action in the learning process (e.g., Tillema, 2000).

Teachers' Misconceptions Regarding Teaching ELLs

Scholars have argued that there are common misconceptions among teachers about teaching ELLs and how a student learns a second-language. Often, these common misconceptions result in teachers' using ineffective teaching strategies, which may lead to negative implications for ELL or inhibit learning. For example, a common teachers' misconception relates to the length of time required to acquire and develop proficiency in a second language (Pettit, 2011). Scholars have indicated that teachers who tend to place ELLs in unnecessary language services do so because they underestimate the influence of the student's knowledge of their first language and the science behind language learning. Consequently, some teachers fail to utilize explicit language in their instructions (De Jong & Harper, 2005; Hardin et al., 2009). Another common misconception among teachers the belief that all ELLs acquire English at the same pace through a universal process, or that instructions for native speakers should be the same instructions used to teach ELLs. Additionally, researchers have found that implementing non-ELL teaching strategies would not be adequate for ELL to develop academic language competencies. Therefore, researchers cautioned that these misconceptions could hinder preservice teachers from using more innovative methods suitable to teach ELL (Busch, 2010; Wong, 2010).

Teacher-Preparation Programs

Research has examined the influence of pedagogical-methods courses and field-experience courses throughout teacher education programs on preservice teachers' thoughts and beliefs about their teaching practice (e.g., Clift et al., 2005). Researchers have found conflicting results regarding the impact of teachers' preparation programs and professional development on ELL teachers. For example, while research has found that there is a direct influence of teachers' preparation programs on their ability to teach ELLs and there is strong relationship between teachers' preparation programs and their beliefs about teaching culturally diverse students, other research has found nonsignificant or no influence of these factors on the teachers' perceptions, and in a few cases, attending training about diversity may lead to teachers' negative beliefs and attitudes toward ELLs (Garcia & Guerra, 2004; Irvine, 2003; McDiarmid & Price, 1990). For example, Peacock (2001), conducted a study to monitor preservice teachers' beliefs after attending a 3-year -

long study of TESL methodology and found that the preservice teachers' beliefs about teaching demonstrated nonsignificant change.

These nonsignificant or no-influence findings contrast with the findings of other studies which reflect that teachers who have taken coursework involving ELL teaching strategies have more positive attitudes toward ELL (Byrnes et al., 1997; Flores & Smith, 2009; Youngs & Youngs Jr, 2001). Additionally, a few studies have found strong evidence that teacher-preparation programs do in fact help change teaching beliefs toward ELLs and that teachers who attend professional development regarding the use of ELLs' first language in classroom instructions, helped them to become successful ELL teachers (August & Shanahan, 2007; Bernhard et al., 2005; Cho & DeCastro-Ambrosetti, 2005; Friend et al., 2009; Karathanos, 2009; Levine, 2006; Pappamihiel, 2007).

Purpose of the research

This study investigated preservice teachers' self-efficacy and attitude in working with ELLs in Arkansas. The investigator employed a within-subject design to examine the interrelationships among social cognitive variables (self-efficacy, motivation, and teachers' preparation programs) and their role in predicting preservice teachers' confidence to teach ELLs in their future classrooms.

Hypotheses of the study/ Sub-problems

H1: Preservice teachers who are attending educational programs will have strong intrinsic motivation to teach ELLs.

H2: Preservice teachers who are attending educational programs will have high confidence to teach ELLs.

H3: There will be a strong and positive correlation between preservice teachers' level of confidence and their ability to create instructional strategies and engage ELLs and manage ELLs classroom.

H4: Preservice teachers' self-efficacy, years of teaching, and ability to speak a second-language are factors that equally predict their self-efficacy level to teach ELLs in future classrooms.

METHOD

Research Research Model

This study employed a within-subject design to investigate preservice teachers' self-efficacy in working with ELLs in Arkansas. The primary source of data was collected from a convenience sampling of 53 graduate and undergraduate preservice teachers enrolled in educational courses in a College of Education in a southern university in Arkansas.

Participants

The participants were 53 preservice teachers enrolled in graduate and undergraduate educational courses during Fall 2022. Participants were 43 female, 9 male and 1 reported as non-binary. The reported age range was as follows:14 students between 18-21 years, 3 students between 22-25, 4 students between 26-30, 11 students between 31-40, and 21 students 40 years or older. Preservice teachers were enrolled in graduate courses: EDMD 5033 Introduction to Instructional Technology, MAT 5703 Technology for Teaching and Learning, EDMD 6313 Instructional Design and Product Development, EDMD 6163 Internet Resources, EDMD 5053 Online Course Development with Multimedia, and undergraduate course: EDMD 3013 Integrating Instructional Technology). Participants were enrolled in different educational majors: 4 students in early childhood education, 11 students in elementary education, 6 students in other middle level, 15 students high-school and 17 students other teaching majors such as Physical or Special education. Participants were non-science majors and attending different educational majors in Early Childhood, Elementary, Middle-Level, High-School and Physical Education. All of the participants' native language was English.

Preservice teachers are students who are enrolled in eduction programs and are undergoing teacher training. Preservice teachers are trained to accommodate ELL students through a combination of coursework, field experiences, professional development, and collaboration with other professionals. They also engage in developing effective strategies for teaching ELLs. These courses cover topics such as second language acquisition, bilingual education, and teaching strategies for ELLs. They also address cultural and linguistic diversity in the classroom and provide preservice teachers with a foundation for understanding the unique needs of ELLs.

Data Collection Tools

The investigator used the following instrumentations to collect data from preservice teachers:

Demographic Survey: A 9-question demographic survey. This survey was designed to collect information on preservice teachers' demographic makeup, such as participants' gender, age range, years in college, major, ethnicity, and teaching experience.

Preservice Teachers' Sense of Self-Efficacy Scale: This study utilized a modified version of the Teachers' Sense of Efficacy Scale designed by Tschannen-Moran and Woolfolk Hoy (Tschannen-Moran & Hoy, 2001). The reason for using this scale relates to its comprehensiveness, integrity, and ease of administration. The current study utilized the short form and included three subscales: (1) efficacy in student engagement, (2) efficacy in instructional strategies, and (3) efficacy in classroom management. The 12-question 11-level Likert scale questionnaire was given to preservice teachers to assess their perceived self-efficacy. The 11-point scale ranged between "Cannot do at all" at zero to "Highly certain can

do" at 10. Students were asked about their degree of confidence to successfully complete a task related to working with ELLs. The total reliability of the questionnaire was calculated based on the data collected in the present study and found to be 0.95 by using Cronbach's alpha, as reported in Table 1.

Table 1

The Total Reliability of the Questionnaire Teachers' Sense of Efficacy Scale

Cronbach's Alpha	N of Items
.953	3

Intrinsic Motivation and Belief Scale: This scale was developed to measure preservice teachers' intrinsic motivation and beliefs regarding teaching ELLs. The scale consists of seven Likert-scale questions related to seven different questions about motivation and beliefs. Participants are asked to select one of five responses for each of the seven statements from "strongly agree" to "strongly disagree".

Data Analysis

Participants in all courses completed the demographic, self-efficacy and intrinsic motivation and belief surveys during week 8 of the fall semester 2022. After completing the survey, the investigator analyzed the quantitative data using Statistical Package for the Social Sciences (SPSS) to test the research questions and hypotheses.

Ethical considerations

In this study, all rules stated to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were not taken.

Ethical review board name: (Arkansas Tech University Institutional Review Board)

Date of ethics review decision: (October 4, 2022)

Ethics assessment document issue number: (E-2022-11)

RESULTS

Prior to analyses, data were screened for systematic patterns of missing data (e.g., when no value was stored for the variable within variable sets) and it was found that the missing values were scattered evenly across variables and groups with small number of cases and no apparent patterns or clusters emerging.

To measure the internal consistency of the self-efficacy survey items (the index of the reliability of the used survey), the investigator calculated the intra-class correlation coefficients to evaluate the consistency of the self-efficacy survey items. The investigator computed the Cronbach's alpha to measure reliability and internal consistency of the reliability estimate. Normally, the theoretical value of alpha ranges between zero to 1. The collected data from self-efficacy survey in this study showed that the Cronbach's alpha value was 0.95. This alpha value can indicate with confidence that there is an excellent internal consistency of the reliability estimates in the survey. Therefore, the interrelationship and homogeneity among all the survey items are excellent in terms and all questions are consistent with one another and measuring preservice teachers' self-efficacy level. Table 2 summarizes the intraclass-correlation coefficient of the self-efficacy survey items.

Table 2

Intraclass Correlation Coefficient

	95% Confidence Interval		F Test with True Value 0			
Intraclass Correlation [b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
.867[a]	.799	.916	21.310	52	104	.000
.951[c]	.923	.970	21.310	52	104	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

Question 1: What is the level of preservice teachers' intrinsic motivation to teach ELLs?

To address this question, the investigator conducted descriptive statistical analysis to examine preservice teachers' level of intrinsic motivation to teach ELLs. The aggregates of total scores show that the average score across 2 items (total of 10 points) of preservice teachers' level of intrinsic motivation to teach ELLs among female students was (n =43) (M = 9.9, SD = .48) and the level of intrinsic motivation to teach ELLs among male students was (n = 9) (M = 8, SD = 2.45). Table 3 and figure 2 summarize the comparison of preservice teachers' motivation to teach ELLs in Arkansas.

Table 3

Preservice Teachers' Motivation Level to Teach ELL in Arkansas (10 Points)

	Female	Male
Total scale 10 points	9.9	8
Standard Deviation	0.48	2.45

Total of preservice teachers of motivation is constant when Gender= non-binary.

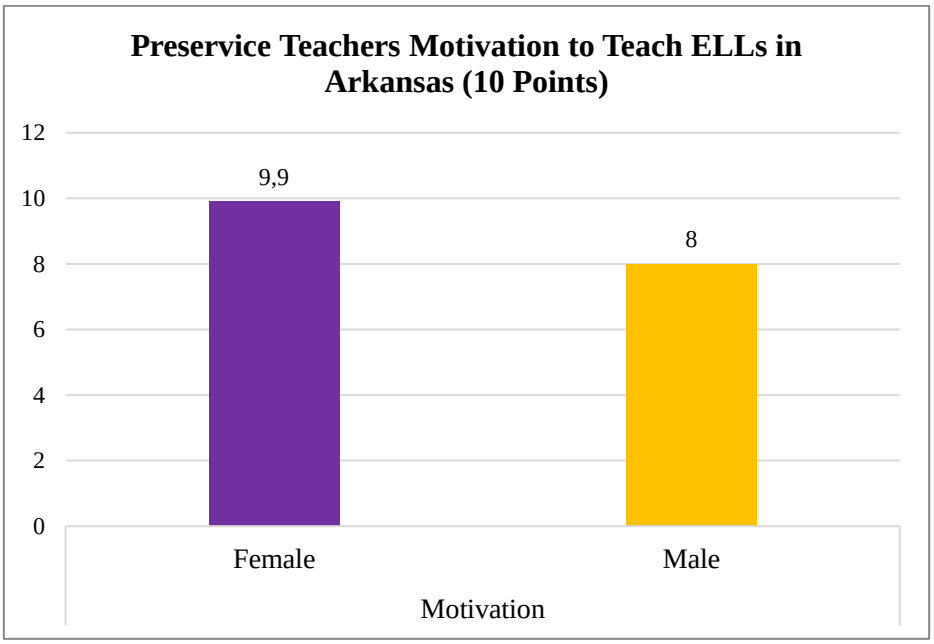

Figure 2: *Preservice Teachers' Motivation to Teach ELLs in Arkansas*

Question 2: How confident are preservice teachers to teach ELLs in Arkansas?

To address this question, the investigator conducted descriptive statistical analysis to examine preservice teachers' level of confidence to teach ELLs in Arkansas.

The aggregates of total scores show that the average scores across 12 items (total of 1200 points) of preservice teachers' self-efficacy to work with ELLs among all students was (n 53) (M = 747.74, SD = 295.59). The investigator examined the data further and found that the self-efficacy average score among female students was (n =43) (M = 793.02, SD = 272.81) and the self-efficacy average of male students was (n = 9) (M = 568.89, SD = 340.49). Tables 4, 5, figures 2 and 3 summarize the comparison of preservice teachers' self-efficacy average scores to teach ELLs in Arkansas.

Table 4

Comparison of preservice teachers' self-efficacy average scores to teach ELLs in Arkansas

	Female	Male	All Students
Total scale 1200 Points	793.02	568.89	747.74
Standard Deviation (SD)	272.812	340.494	295.59

Table 5

Comparison of preservice teachers' self-efficacy percent scores to teach ELLs in Arkansas

	Female	Male	All Students
Self-efficacy percent 100%	66.10%	47.41%	63.31%

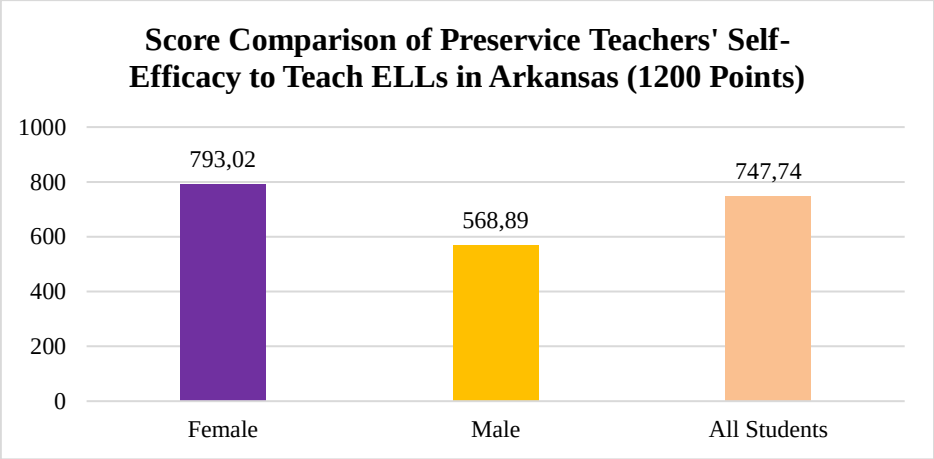

Figure 3: *Self-Efficacy Average Scores Comparison to Teach ELLs in Arkansas*

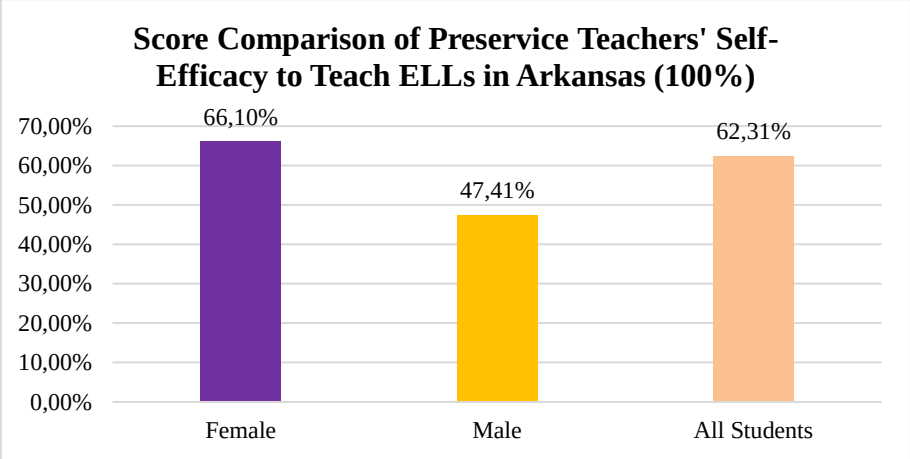

Figure 4: *Self-Efficacy Scores Percent and Comparison to Teach ELLs in Arkansas*

Question 3: Is there a correlation among what is preservice teachers' level of confidence to create instructional strategies, their ability to engage ELLs, and manage ELLs classroom?

To answer this question, the investigator conducted a Pearson product-moment correlation coefficient to assess the relationship between preservice teachers' level of confidence to create instructional strategies, their ability to engage ELLs, and manage ELLs classroom. The results showed that there was strong and positive correlation between self-efficacy to engage ELLs and self-efficacy to create instructional strategies for ELLs, r (53) = .935, p = 0.001. Further, the results showed that there is correlation between self-efficacy to engage ELLs and self-efficacy to manage ELLs classroom, r (53) = .821, p = 0.001. Table 6 summarizes the correlation analysis.

Table 6

Results of correlation between preservice teachers' level of confidence to create instructional strategies, engage ELLs and manage ELLs classroom

	Pearson Correlation	**Self-Efficacy to engage ELLs**	**Self-Efficacy to create instructional strategies for ELLs**	**Self-Efficacy to manage ELLs classroom**
Self- Efficacy to engage ELLs	Sig. (2-tailed)	1	.935***	.821**
	N		.000	.000
		53	53	53

**. Correlation is significant at the 0.01 level (2-tailed)

Question 4: What factors best predict preservice teachers' confidence to teach ELLs in future classrooms?

To address this question, the investigator conducted multiple-regression analysis.

Multiple-Regression Assumptions: The regression descriptive statistics output was checked for multicollinearity assumptions between predictor variables and found that correlations between variables were less than 0.6, and, therefore, none of included predictors has multicollinearity. Further, all predictor variables (speaks a second-language, intrinsic motivation, and teaching experience) correlate with the outcome variable (Preservice teachers' self-efficacy to teach ELLs in Arkansas) at a value greater than 0.3. The linear relationship between the independent variables and the dependent variable (preservice teachers of self-efficacy) was checked through the probability plot and found that all points were following a straight line. Then the scatter plot was checked and found that regression standardized residual on the y-axis and the regression standardized predicted value on the x-axis within negative 3 to 3. The standard residual found the minimum was -2.628 and the maximum 1.367. Finally, the investigator checked the Cooks Distance and found that the minimum was .000 and the maximum .677; thus, it was less than 1. ANOVA table showed that there is statistical significance, and, therefore, the null hypothesis is rejected. The researcher used the R-square (this research has adequate sample size 53 participants).

Multiple-Regression Analysis: *Regression finding:* Multiple linear regression analysis was conducted to develop a model predicting preservice teachers' confidence to teach ELLs in future classrooms. The predictor model was able to account for 21% of the variance in the dependent variable and was statistically significant at $p < .001$. Individual predictors were examined further, and the result indicated that the independent variable regarding speaking a second-language was found to be a significant predictor of preservice teachers' self-efficacy (t = 2.960, p = .005) and the preservice teachers' intrinsic motivation was found to be a significant predictors of preservice teachers' self-efficacy (t = 2.609, p = .012). Basic descriptive statistics and regression coefficients are summarized in Tables 7 and 8.

Table 7

Descriptive statistics: a. Predictors: (Constant), Currently Teaching, preservice teachers', intrinsic motivation, speak a second-language. b. Dependent Variable: preservice teachers' self-efficacy to work with ELLs.

	Mean	Std. Deviation	N
Preservice teachers' self-efficacy	747.74	295.594	53
Speak a Second Language	1.11	.320	53
Preservice teachers' intrinsic motivation	9.58	1.278	53
Currently Teaching	1.60	.494	53

Table 8

Model Summary: Multiple Regression analysis. a. Predictors: a. Predictors: (Constant), Currently Teaching, Total of intrinsic motivation of preservice, Speak a Second-Language. b. Dependent Variable: preservice teachers' self-efficacy to work with ELLs.

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.461[a]	.212	.164	270.294	.212	4.397	3	49	.008

a. Predictors: (Constant), Currently Teaching, Total of intrinsic motivation of preservice, Speak a Second- Language

b. Dependent Variable: Total of preservice teachers' self-efficacy

DISCUSSION

This study investigated preservice teachers' motivation and self-efficacy in working with ELLs in Arkansas. The main finding of this study is that preservice teachers who are

attending educational programs were found to have high levels of motivation and self-efficacy to work with ELLs. Further, the results of this study revealed that preservice teachers demonstrated strong and positive correlation between their level of confidence to engage ELLs in class activities, to create instructional strategies tailored for ELLs, and their ability to manage ELLs classroom environment effectively. Finally, the results of this study found that speaking a second-language and the level of intrinsic motivation are significant predictors of preservice teacher's self-efficacy to work with ELLs.

The first finding of the present study is consistent with previous findings produced in the context of preservice and in-service teachers in other studies. For example, our finding that preservice and in-service teachers who are attending educational training programs showed positive motivation toward teaching ELLs in Arkansas and was found to be similar to other recent studies conducted in the midwestern U.S. or south Texas (Durgunoglu & Hughes, 2010; Salas et al., 2006). However, other earlier studies found conflicting results, where preservice teachers were less motivated to teach ELLs (e.g., Artiles & McClafferty, 1998; McDiarmid & Price, 1990). A possible interpretation of these conflicting results may stem from real differences in attitudes among preservice teachers due to their ethnic backgrounds (Salas et al., 2006). Additionally, these results may simply be a product of biased samples as a result of employing a non-random sample to select participants. The present study employed convenience sampling. However, these interpretations need to be examined in future studies.

The second important finding of the present study is that preservice teachers' confidence to teach ELLs correlates strongly and positively with their abilities to engage ELLs in classroom activities, their ability to create effective instructional strategies for ELLs and their ability to successfully manage ELLs classrooms. This result proved to be consistent with other studies conducted previously with preservice teachers who are attending educational-preparation programs (e.g., Lopez, 2018; Mantero & McVicker, 2006). A possible interpretation of this result is that preservice teachers who are attending educational-preparation programs are trained to use diverse teaching strategies in a wide variety of conditions and with diverse learners, including ELLs and students with exceptionalities. For example, some studies suggested that preservice teachers who attended a semester-long educational course developed empathy and positive perceptions towards ELLs, and felt more prepared to teach ELLs (e.g., Turgut et al., 2016). Conversely, other studies found that preservice teachers who did not receive training related to ELLs pedagogy they felt less confident to teach ELLs (e.g., Bruggink et al., 2016; Everling, 2013; Yoo, 2016).

Finally, the result of the present study indicated that there are two factors that can predict preservice teachers' confidence to teach ELLs, namely, their ability to speak a second language and their level of motivation to work with ELLs. In general, this result proved to be consistent with other studies, which found that teachers who speak a second-language other than English have higher self-efficacy than teachers who do not (Chu & Garcia, 2014;

Gándara et al., 2005; Paneque & Barbetta, 2006; Siwatu, 2011). A possible interpretation of this result is that preservice teachers' language background is relevant to how they perceive language learning. The positive effect of a second language could be due to the fact that preservice teachers would not consider language learning to be an impossible task and, consequently, would enhance their self-efficacy. In contrast, preservice teachers who have never learned a second-language would perceive language learning as difficult or nearly impossible. This interpretation was found to be supported by other research, where preservice teachers who studied a second language viewed second-language learning as easy; consequently, they have a high degree of motivation to work with ELLs, are more supportive of ELLs than monolingual preservice teachers, and are more sympathetic toward the challenges facing ELLs in terms of the effort and the motivation required to learn or master a second-language (e.g., Dixon et al., 2016; Ellis, 2004; Salas et al., 2006). Furthermore, other studies found that teachers with at least an intermediate level of proficiency in another language are better prepared to teach ELLs. Consequently, gaining intermediate or advanced proficiency in a language other than English may help preservice teachers gain sympathy for ELLs (Coady et al., 2011).

LIMITATIONS AND RECOMMENDATIONS

This study presents the results regarding preservice teachers' self-efficacy and attitude in working with ELLs in Arkansas and highlights the important role the educational-training programs play in preparing future teachers to work with ELLs. Therefore, it is recommended that future ELL teachers to go through pedagogical training to learn about different methods of planning classroom activities, techniques to create effective instructional strategies and classroom management suited for ELLs. Second, the present study emphasizes that learning a second- language by preservice teachers will help them to become supportive and more sympathetic toward the challenges facing ELLs, and, consequently, language learning can help influence preservice teachers' attitudes toward ELLs.

Although the current study addressed the proposed questions and the theoretical framework, there may be some possible limitations in relation to the population and the absence of previous studies in Arkansas. For example, the participants were just fifty-three preservice teachers selected via convenience sampling from one university. Therefore, a larger sample size recruited from multiple sites would need to be undertaken to fully measure preservice teachers' self-efficacy and motivation to teach ELLs in Arkansas. Furthermore, the number of participants in this present study was relatively small, and, therefore, it would be difficult to generalize and identify significant relationships or connections within our data set. Another limitation of this study is that there is an absence of previous studies to compare the results or assess the trend of preservice teachers' self-efficacy and motivation to teach ELLs in Arkansas.

CONCLUSION

The main finding of this study is that preservice teachers who are attending educational programs have high-levels of motivation and self-efficacy to work with ELLs in Arkansas. Furthermore, the results of this study revealed that preservice teachers show a strong and positive correlation between their level of confidence to engage ELLs in class activities, to create instructional strategies tailored for ELLs, and to manage ELLs classroom environment. Finally, the results of this study found that speaking a second-language and the level of intrinsic motivation are significant predictors of preservice teachers' self-efficacy to work with ELLs in their future classrooms. In general, these results are consistent with previous findings produced in the context of preservice and in-service teachers.

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Biographical notes:

Reem Ibrahim: Reem Ibrahim is an English language instructor at the American University in Cairo at the School of Continuing of Education. Reem served as a Graduate Assisstant and taught English Composition Workshop at Arkansas Tech University. She holds a master's degree in Teaching English to Speakers of Other Languages from Arkansas Tech University and a bachelor's degree from Misr University for Science and Technology Cairo, Egypt.

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APPENDIX

Demographic Survey

Gender

- Male
- Female
- non-binary

Fluent in English

- Yes
- No

Age Range

- 18-21
- 22-25
- 26-30
- 31-40
- 41 or over

Years in College

- Freshman
- Sophomore
- Junior
- Senior

Major

- 1 Early Childhood Education
- 2 Elementary Education
- 3 Other Middle Education
- 4 High School

- 5 Other

Describe Yourself

- 1 American Indian / Native American
- 2 Asian
- 3 Black / African American
- 4 Hispanic / Latino
- 5 White / Caucasian
- 6 Pacific Islander

Currently Teaching

- Yes
- No

Worked with Culturally Diverse Students

- Yes
- No

Speaking a Second Language

- Yes
- No

Preservice Teachers' Self-Efficacy Regarding ELLs

Please rate your competence in ELL instruction on a 100-point scale with 0 representing "Cannot do at all" and 100 representing "Highly certain can do". You should answer these questions to the best of your knowledge by circling the choices that most accurately reflect your current situation. All your responses will be confidential.

Please mark your level of confidence of conducting the following tasks with ELLs:

1. Control disruptive behavior of ELL students in the classroom?
2. Motivate ELL students who show low interest in schoolwork?
3. Get ELL students to believe they can do well in schoolwork?
4. Help your ELL students value learning?
5. Craft good questions for your ELL students?

6. Get ELL students to follow classroom rules?
7. Calm an ELL student who is disruptive or noisy?
8. Establish a classroom management system with each group of ELL students?
9. Use a variety of assessment strategies with ELL students?
10. Provide an alternative explanation for example when ELL students are confused?
11. Assist ELL students' families in helping their children do well in school?
12. Implement alternative strategies for ELL students in the classroom?

Preservice Teachers' Intrinsic Motivation Regarding ELLs

Please select one response for each of the following statements

1. Strongly Agree
2. Somewhat Agree
3. Neutral
4. Somewhat Disagree
5. Strongly Disagree

- I would like to help all students, especially second language and diverse learners.
- I would like to continuously develop my teaching skills to help all students academically, especially second language and diverse learners.

Preservice Teachers' Beliefs Regarding ELLs

Please select one response for each of the following statements

1. Strongly Agree
2. Somewhat Agree
3. Neutral
4. Somewhat Disagree
5. Strongly Disagree

- Teachers should not be expected to adjust their preferred mode of instruction to accommodate the needs of all students.
- Students and teachers would benefit from having a basic understanding of different cultures.
- All students should be encouraged to become fluent in a second language.
- Second language learners should be placed in the regular classroom whenever possible.
- Students living in non-English-speaking households can benefit socially from participating in racially integrated classrooms.

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Research

STEM Integrated Curriculums in Early Childhood Education: An Exploration of Teachers' Pedagogical Beliefs and Practices

Sara Movahedazarhouligh[1] **Hengameh Kermani**[2] **Jale Aldemir**[3]

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Young children are perfectly adapted to learning STEM concepts. A growing body of research indicates that experiences with science, Technology, Engineering, and Mathematics (STEM) are critical in preparing young children to think critically and creatively and solve problems. These are valuable skills young children need to succeed in school, work, and life. This raising awareness of STEM education needs has pushed for STEM integration in early childhood (EC) settings while giving limited attention to the teaching of STEM in the EC field and targeted STEM professional development programs. This qualitative study aimed to explore the EC teachers' pedagogical beliefs and practices about STEM-integrated curriculums and STEM teaching in pre-K settings after attending a series of STEM integration teacher professional development programs in an eastern state in the United States. Five EC teachers participated in in-person interviews after attending a series of professional development sessions designed to help teachers develop both content knowledge and pedagogical knowledge related to the STEM curriculum. A qualitative inductive approach was used for the data analysis. The analysis of data collected from interviews with EC teachers revealed that they were positively impacted by the STEM-integrated professional development, resources, and materials available to implement the STEM units. According to the teachers' beliefs, children were also positively impacted by their teacher's professional learning and high confidence in teaching STEM-related topics and activities. A discussion of the findings and implications for future research and practice is presented. Recommendations are also discussed for how teachers can effectively teach integrated STEM education.

STEM; STEM integration; STEM curriculum; Early childhood; Pre-k, Professional development

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[1] Assistant Professor, University of North Carolina Wilmington, Wilmington, NC. Movahedazarhoulighs@uncw.edu
Orcid ID: 0000-0002-0399-0105
[2] Associate professor, University of North Carolina Wilmington, Wilmington, NC. Kernamih@UNCW.edu,
Orcid ID: 0000-0003-1041-2124
[3] Associate professor, New Jersey City University, Jersey City, NJ. jaldemir@njcu.edu
Orcid ID: 0000-0001-8515-3708

INTRODUCTION

As the studies on science, technology, engineering, and mathematics (STEM) in early childhood (EC) education overwhelmingly focus on child learning outcomes, factors such as early childhood teachers' belief about STEM integration as well as their professional preparation to fully embrace STEM in their classroom are yet waiting to be investigated and understood (Martín-Páez et al., 2019). Integrated STEM education is **an effort to combine science, technology, engineering, and mathematics into one class that is based on connections between the subjects and real-world problems**. However, in general, integrated STEM education can involve multiple classes and teachers do not have to always involve all four disciplines of STEM (Hapgood et al., 2020). Research shows that introducing STEM into the class curriculum before the age of eight can have a significant impact on children's academic success and support learning later in life, in STEM and other areas, such as developing reading and language skills (Chen et al., 2021; MacDonald et al., 2020; Ryu et al., 2019). Young learners can understand relatively advanced concepts and enjoy learning experiences that explore such concepts. It is argued that STEM education should start in early childhood since concepts at the heart of STEM, including curiosity, creativity, collaboration, and critical thinking, are in demand (Hapgood et al., 2020).

Research also consistently shows that an earlier introduction to STEM education provides interdisciplinary development across numerous subjects, including literacy. When STEM is introduced early to young minds, they are given the opportunity to communicate and explain complex reasoning, an essential skill in language development. This complementary effect is seen across various interdisciplinary studies (Chen et al., 2021; Margot & Kettler, 2019). STEM helps young minds exercise skills and functions that influence their learning, such as problem-solving, critical thinking, conceptual learning, and verbal communication skills. The stronger these skills are at a young age, the easier the mind can absorb, categorize, and utilize information in later studies and across various subjects (Campbell et al., 2006). Moreover, research reveals that incorporating STEM into natural communication environments can support improvement in social communication by building on how children learn and explore the world while supporting the exploration of STEM concepts by promoting questioning and problem-solving (Moore et al., 2020). Although children show natural curiosity about their world and a remarkable capacity for independent learning, they need adult assistance to support, guide and build on their interests to ensure adequate early STEM experiences (Martín-Páez et al., 2019). At present, it seems that inadequate attention is being paid to the teaching of STEM in EC education. Less than five percent of instructional time in formal EC education settings is devoted to STEM learning. This may partly be due to EC education providers being inadequately prepared for STEM teaching, including few EC teachers who have taken the full complement of STEM courses in life sciences, natural sciences, and mathematics as part of

their formal education and may need formal training in these fields as part of their professional development (PD) (Wan et al., 2021). According to NAE and NRC (2014), STEM literate means (1) awareness of the roles of science, technology, engineering, and mathematics in modern society; (2) familiarity with at least some of the fundamental concepts from each area; and (3) a basic level of application fluency (e.g., the ability to critically evaluate the science or engineering content in a news report, conduct basic troubleshooting of common technologies, and perform basic mathematical operations relevant to daily life) (p. 34). It is argued that STEM literacy is not a strength of many EC teacher preparation programs and more needs to be done to make sure that EC teachers leave the preparatory programs with enough knowledge, skills, and expertise to implement STEM units with quality and confidence in their classrooms as teachers are the essential agent in establishing a STEM-integrated early childhood curriculum (Wan et al., 2021).

STEM-Integration: What Research Shows

As a growing field of study, STEM integration in EC education has started taking its fair share in the research literature. Brenneman et al. (2019) designed a professional development (PD) model to empower preschool educators to provide rich, high-quality STEM learning experiences, particularly working in schools serving children from culturally and linguistically diverse backgrounds. The authors reported that their model was relevant, effective, culturally appropriate, and flexible enough to be implemented within any curricula and with a variety of materials for teachers and children. Their model resulted in considerable academic and developmental gains for the serving students and relevant PD for the participating teachers. In another study by Ryu et al. (2019), an integrated- STEM education methods course was developed for preservice teachers in STEM disciplines. The authors reported that while the students successfully developed STEM integration lessons and taught them, they faced challenges attributable to current school practices, limited interdisciplinary understandings, and a lack of role models. Bagiati and Evangelou (2015) examined a preschool teacher's experience implementing an early engineering curriculum. The findings revealed that different factors either discouraged or facilitated the implementation of the early engineering curriculum in early childhood education classrooms. Deterring factors were teachers' hesitation in trying specific instructional methods, lack of time to invest in engineering activities, and developmental differences among children. On the other hand, the facilitating factors included constructive feedback post-implementation of the curriculum, the teacher's confidence gained through her years of experience, and collaboration with parents. The authors also reported that the teacher's motivation, willingness to try new ideas, and critical reflection on their practice boosted the positive outcomes of their study.

Teachers need sustained science-specific training to make STEM education a success. Atiles et al. (2013) examined whether PD in science education would enhance EC teachers' content knowledge and self-efficacy in teaching science. The study results revealed

that ongoing PD significantly improved teachers' knowledge of science concepts and their self-efficacy toward teaching science. The researchers in this study stressed the importance of modeling and hands-on training toward science activities incorporated into the PD of early childhood teachers. As PD would also need to include other aspects of STEM besides science. Technology, engineering, and mathematics would need to be incorporated as well. Guzey et al. (2016) designed and delivered a year-long teacher PD program to address the need to support science teachers in teaching science while focusing on more and deeper connections among STEM subjects. The findings revealed that the teachers developed STEM integration curricular units that address the characteristics of the STEM integration framework and STEM-ICA, which are supported by the literature and new reform documents.

Teachers' Belief

In the teaching profession, teachers' early memories of schooling, type of PD, and interactions with different stakeholders (e.g., school administration, family, community members, media, etc.) play a significant role in shaping their beliefs (Chen et al., 2021). Kagan defines teachers' beliefs as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (Kagan, 1992, p. 65). Fang (1996) argues that "teachers' theoretical knowledge and beliefs" (p. 49) influence their curriculum design decisions and, consequently, the instructional methods they utilize, as well as the quality and depth of the interactions they have with their students in class. Furthermore, Teachers' theoretical knowledge and beliefs could impact the value a teacher places on teaching certain subject matters or different instructional methods. Chen et al. (2014) report that early childhood teachers' beliefs about what is more important in young children's education influence their decision regarding what to prioritize in the classroom. The authors further argue that misinterpretation of child-centered Developmentally Appropriate Practice (DAP) causes practitioners to think that content areas such as math are inappropriate to prioritize in early childhood education. This notion is an example of how teachers' beliefs often function as mechanisms to either confirm or refute new professional knowledge and skills that demand a change in their existing teaching practice. Park et al. (2016) studied early childhood teachers' beliefs about their readiness to teach STEM concepts. The researchers specifically examined the relationship between their practical experience in class and their perception of teaching STEM in early childhood. Participants were also prompted to list the challenges they might encounter with incorporating STEM into their curriculum and instruction. Lack of time to plan, lack of resources, inadequate PD and administrative support, lack of knowledge about STEM topics, lack of parent participation, and lack of collaboration with other teachers were among the challenges they mentioned. This study's results implicate that more PD is needed to transform teachers' perceptions about the importance of STEM in early childhood education. Such PD must equip teachers with comprehensive content knowledge, pedagogical strategies, and skills to plan and instruct STEM-integrated curricula in their classrooms.

Purpose of the Study

Unfortunately, research shows that many teachers, particularly EC teachers, not only lack confidence in teaching STEM subjects but are also ill-prepared in content and pedagogy to effectively engage young children in developmentally appropriate STEM learning (Aldemir & Kermani, 2017; Simoncini & Lasen, 2018). For EC programs to include quality STEM education, it is important to understand teachers' beliefs and perceptions about STEM-related PD. As a critical factor in young children's development, teachers hold prior views and experiences that will influence their STEM instruction (Brenneman et al., 2019). The view of EC teachers presented in this paper helps us explore some pedagogical beliefs about a newly recognized phenomenon: science, technology, engineering, and math (STEM) integration in the early childhood education curriculum following a series of PD sessions. The review of research literature also revealed that there is limited research looking at early childhood teachers' pedagogical beliefs regarding STEM integrated curriculum. Thus, this study aimed to explore the EC teachers' pedagogical beliefs and practices about STEM integrated curriculums and teaching STEM in pre-K settings after attending a series of STEM integration teacher professional development programs. The following research question guided this study:

> RQ: How did the EC teachers perceive the impact of STEM-integrated PDs on their pedagogical beliefs and practices about STEM integrated curriculums and STEM teaching in pre-K settings?

STEM Integrated Curriculum Professional Development Project

The lead teachers in this study received a series of PD sessions designed to help teachers develop both content knowledge and pedagogical knowledge related to the STEM curriculum. The same PD series were also extended to all five teacher assistants from those classrooms. However, they could not participate fully due to other tasks and responsibilities at school (e.g., driving the bus, helping with afterschool duties, etc.). Each teacher participated in three formal PD sessions over the course of the study. The study was completed in 10 weeks (March through mid-May). PD sessions were continuous (90 minutes each) and facilitated by two researchers and a former kindergarten teacher with expertise in science and engineering. The content of each PD session targeted the STEM curriculum topics pre-selected by the teachers themselves: living and non-living, ocean animals, human body, weather and water, and motion. All the topics were explored via project-based learning activities. In each session, the participants discussed, brainstormed on teaching strategies and activities, and investigated and practiced the process as they would in the classroom with a group of young children. Moreover, two researchers served as mentors and support for engaging teachers in conversations about their practice and helping plan and implement units/projects when needed.

METHOD

Research Approach

Based on the nature and number of the participants, a qualitative research approach was used to gain a rich description of the participants' experiences and perspectives (Hatch, 2002). According to Merriam (2009), qualitative researchers are "interested in understanding how people interpret their experiences, how they construct their world, and what meaning they attribute to their experiences" (p.5). A phenomenological design was chosen to understand the participants' perceptions. Phenomenological design in qualitative research focuses on lived experiences of participants about a phenomenon and includes the study of "phenomena," including appearances of things or things as they appear in people's experiences along with relevant conditions of experiences (Creswell, 2013). In this study, we considered the EC teachers' lived experiences throughout the STEM-integrated PDs as the phenomenon.

Participants and Settings

Participants included five teachers, three from a public Pre-K Center and two Pre-K teachers from a Head Start program in a small town in an eastern State in the US. All five teachers were female (Four White and one African American), ranging in age from 29 to 40. As lead teachers in their classroom, they were responsible for planning and implementing the curriculum and assessing their students. All five teachers were licensed in Birth-Kindergarten, and two of them also enrolled in a graduate program. The teachers' experience at the Pre-K level ranged from three to ten years as lead teachers. All five teachers volunteered to participate in this study and were willing to share their project work and documentation as part of this research. Please see Table 1 for a summary of the participants' demographics.

Table 1

Participants' Demographic

	Age	Gender	Work Experience (years)	Ethnicity	Educational Degree	Program Setting
Teacher#1	34	Female	6	White	B. A	Public Pre-K
Teacher#2	30	Female	3	White	B. A	Head Start
Teacher#3	29	Female	5	White	B. A	Public Pre-K
Teacher#4	33	Female	5	White	B. A	Public Pre-K
Teacher#5	40	Female	10	African American	B. A	Head Start

Data Collection

Once University Institutional Review Board (IRB) approval was granted, early childhood teachers at two public schools (public Pre-K and Head Start) were approached and invited to participate in the study. Formal invitation letters were sent to all lead teachers at the public Pre-K and Head Start programs. Head Start/Early Head Start (HS/EHS) is a federal program in the U.S. that promotes children's school readiness from birth to age five from low-income families by enhancing their cognitive, social, and emotional development. To qualify, families must have an annual household income (before taxes) below the specific amounts established by the federal agencies (U.S. Department of Health and Human Services, 2020). Three public Pre-K and two Head Start teachers expressed interest and volunteered to participate in the study. Upon receiving teachers' interest in participation, the researchers met with the participants in person, reviewed the study procedures, and addressed all the questions about participation. Permission to participate in the study was obtained through verbal and written consent of the participating teachers. The data was collected through in-person interviews lasting 90-120 minutes each (Please see Table 2 for interview questions). The interviews were scheduled one week after the STEM integration PD completion. All interviews were done in person and conducted by one of the researchers who was not involved in the PD sessions as a mentor or support and had minimal contact and familiarity with the participants.

Table 2

Interview Questions

1. Please describe your experience of participating in this project.
2. What were some of the highlights of implementing STEM in your class? What was the greatest success that you can share?
3. When implementing STEM, what was the response among students?
4. What changes did you notice in children's overall learning? Can you give some specific examples of these changes?
5. How did the project (PD) help with the learning of content in STEM for you or your students?
6. How did this project reinforce or change your attitudes toward math, science, engineering, or technology?
7. How has it reinforced or changed your practice in teaching STEM?
8. Did this project make you want to try other experiences/projects/opportunities with STEM? Why or why not?
9. How do you see yourself (or your colleagues) implementing the STEM model in the following years?
10. What have been some of the challenges to implementing STEM?

The interviews were digitally audio-recorded, while the researcher took notes as a backup for content analysis. Specific prompts related to the interview questions were provided when necessary. Multiple strategies were implemented to establish member checks (Creswell, 2021). First, at the end of each interview, the interviewer summarized the major points EC teachers made to ensure she understood the major points raised and to seek clarification if needed. The interviewer also frequently rephrased EC teachers' comments throughout the process to ensure the data were accurate. Second, EC teachers were offered a copy of the interview transcript for review, although no EC teacher chose to do so. These strategies ensured that the data accurately reflected EC teachers' perceptions.

Data Analysis

The organization of the data and systematic analysis were carried out in line with the procedures delineated by Braun and Clarke (2006) and following the quality indicators of qualitative studies proposed by Brantlinger et al. (2005). An inductive approach was used for the data analysis. First, interviews were transcribed, and an analysis of the descriptive content by reading and rereading the data was performed. Any initial ideas taken from the text were also noted during this first step. Second, the interview's representative topics were categorized based on the developed units of meaning (Willig, 2013). Third, specific topic categories were defined around each of the broad categories. Finally, each topic that had emerged was defined, and the most representative verbatim statements were selected for each. Credibility procedures, such as peer review, were used to ensure that the coding of the topics was consistent. The initial set of codes from the interviews was created by one researcher, who then met with a second researcher to discuss the initial coding frame. The researchers met regularly throughout the coding process to discuss emerging codes and reach a final consensus. Subsequently, each researcher coded two sets of the same interview responses independently to check for coder agreement. The two researchers showed good agreement (78%) in their coding of the same interview responses. For the inconsistencies in the codes, the researcher reached a consensus. Written field notes were also used to examine the trustworthiness of the data throughout the study (Creswell, 2009).

Ethical Considerations

Data collection initiated after securing the Institutional Review Board (protocol number#H1213-099). All participinats signed an infomed consent form before interviews. Names corresponding to audio recordings were kept confidential. Participants could withdraw from the study at any time with no penalty. Pseudonyms were used to protect participants' identity. All data including the recordings and notes, were stored in a locked cabinet. Any computer containing participants' data were password protected. Apart from the researchers, no other persons had access to the data. All data were de-identified and identified data (e.g., voice recordings) will be destroyed three years after final data collection.

RESULTS

Five themes emerged from the analysis of the interview data. The following section explains each piece exemplified with quotations from the participants.

Teacher Learning and Understanding of STEM Curriculum

The STEM curriculum professional development (PD) was designed to allow teachers to become familiar and comfortable with both content and pedagogy surrounding the STEM curriculum. All five teachers were provided STEM-related resources (STEM materials, laptops, iPad, digital cameras, etc.) that they could utilize in their classrooms. Furthermore, the research team supported teachers' curriculum plans with desired materials (informational books, body parts props, PVC pipes, loose parts, learning Apps to supplement the contents, etc.). In their interview, all five teachers reported how their pedagogical practice was impacted by such PD. According to the participants, the PD helped them widen their knowledge and skills in STEM subjects. EC teachers mentioned that the STEM curriculum PD helped them be better teachers because the more they learned, the more they could help children learn in their classes. It was a mutual benefiting process in which they felt empowered to develop themselves professionally and better serve their children and their families. According to one of the participants:

> Prior to the STEM curriculum, the way I looked at things, I was sometimes thinking inside of the box, and it was repetition. You know you come in; you have your morning meeting, and you go to centers. This type of learning occurred all day. Now, it doesn't have to be a small group setting, and it doesn't have to be a center… it can be… learning can occur anywhere, at any time. And sometimes it does have to be planned, and sometimes it's just by chance. So, it's, that's what I gained out of the STEM project.

EC teachers also talked about how the PDs in STEM integration excited them and made them more confident to explore ideas and concepts instead of being overly bossed with the end product. Participants believed that they have been much more intentional in their teaching of STEM, and they could cover the topics and concepts much more in-depth rather than just "zipping through" just for the sake of coverage. They believed that after the PDs, they had great experiences exploring STEM with the children in the class. One of the participants stated:

> Over the years, deep down, I knew of the importance of science for children. I guess I was practicing the "tourist curriculum" without knowing it. Still, for some odd reasons, perhaps my lack of confidence and/or lack of resources, I stayed away from offering authentic science activities. Or, if I did, they were simple activities like fall leaves or superficially studying the plants by naming/labeling their parts. Since the STEM integration curriculum, I am more aware of children's interests, responses, and likes.

The EC teachers also mentioned that STEM curriculum PD made them much more aware of how they were teaching the concepts. It made them much more aware of the questions they ask the children and how they recognize what children are learning. They also expressed appreciation for feeling more focused and purposeful in what we were doing after the STEM curriculum PD. One of the EC teachers shared:

> Like, I was aware I needed to start thinking more about science things and how can we use technology, so like we are videotaping and going to YouTube a lot more. Looking things up on google, showing pre-K kids, you know, we want to find out about trees, so what type of question could we type into the computer? Is this the answer we are looking for, and if not, well, how could we ask our question differently? Stuff that I might not have thought to do with preschoolers before, at least not to that extent!

Overall, the EC teachers shared that they gained a deeper understanding of STEM from a holistic perspective, whereas, before the PDs, all focused more on the science part of the curriculum and skipped the math aspect. All teachers (as explained above) realized that they had often stayed within the boundaries of the common practice employed in their programs regarding curriculum planning. According to the EC teachers, STEM PD sessions encouraged them to try different pedagogical practices, such as intentional teaching or trying different modalities to search for new information.

Increased Confidence in Teaching STEM

As part of the PD, the participants were provided with hands-on learning experiences focused on pedagogical and STEM content knowledge. As mentioned earlier, our goal was to provide the teachers with some of the same STEM-integrated experiences their students will have in the classroom. During the interviews, the EC teachers mentioned that this focus on pedagogical and STEM content knowledge helped boost teachers' confidence in both planning and implementing the STEM-integrated curriculum. Furthermore, EC teachers showed more commitment to STEM as they gained more comfort in handling STEM-related activities and materials. All teachers believed they gained some confidence in STEM, which helped them with planning and implementation. Three of the EC teachers expressed implementing the STEM curriculum in their classrooms with a high level of knowledge, comfort, and pedagogical skills in STEM, whereas two of the teachers shared that they still need more practice to feel confident enough with STEM implementation. One of the EC teachers explained how she learned about STEM as indicated below:

> When we were approached for the STEM project, I bought a book about STEM from teachers' aid--that way, I had a better understanding before actually implementing ideas or lessons into the classroom, and then with our PD days, the booklet and the resources that you brought us it was easy to research different lessons to implement in the classroom.

Similarly, another EC teacher explained how the STEM project helped her shift her focus from getting the correct answers to using the proper process when planning and implementing STEM-integrated lessons.

> The thing about science is that there is no right or wrong answer. When I am planning, I like to be right! But with this project [STEM], I learned that whatever happens, happens! The end is going to be whatever it is. We just learn what happens when we get there and, that's the attitude of a lot of kids too—try it, we didn't get the result we wanted, what can we do to get there? I really enjoyed this process….Now I am more hands-on.

EC teachers expressed that after the STEM curriculum PDs, they were taking a more project-based approach where children could get out to explore by themselves. The STEM PDs provided the EC teachers with a different perspective on their roles as teachers, where they learned to offer more opportunities to children to come up with their own blueprint. This required the EC teachers to step back and give children only the beginning of the tasks and let them figure out the middle and end, something they had not been doing before. The EC teachers also explained children's excitement about the STEM curriculum and new ways of practicing STEM concepts and believed that these strategies have been able to energize their pedagogical practices. According to one of the EC teachers:

> I got really excited when I saw how excited they [children] were, and I was like, yes, this is awesome; it's working! That way, it was easier because then I got into the groove of how they are learning and how they are picking this up. On the other hand, it's harder because then you have to keep up with them. You have to be ready and anticipate what they are going to go with, and you have to be able to be flexible in some ways, but some things we just couldn't do.

Two of the teachers shared that shifting their practices and being prepared to the extent required was somewhat difficult at first. However, they also acknowledged all the benefits and were confident they would continue those practices into next year. As one of the teachers mentioned: "It's like a good habit that I've started to form. It's been so beneficial that we will keep doing what we've been doing these last couple of months".

Need for STEM-Related Materials and Resources

As part of this study, each classroom received a collection of STEM-related materials and resources for children as well as teachers and helped the teachers be more effective in their practice and implementation of the STEM curriculum. During the interviews, all teachers revealed that the provision of STEM-related materials and resources motivated both their learning and teaching practice. All EC teachers believed that an integrated STEM curriculum requires appropriate and stimulating materials and resources for teachers as well as children to investigate, problem-solve, design, and test and retest hypotheses. If schools do not have sufficient funds to afford appropriate

materials and consumable supplies, it might hinder teachers from effectively engaging their students with STEM-related activities. One of the EC teachers shared:

> I can encourage this STEM curriculum, but having the tools to support that, like having the iPad and the internet, the laptops, and digital cameras for them to document their own stuff, makes it more exciting. So, I think they felt like they [children] had more independence and control over what they were learning.

The EC teachers also expressed their appreciation for the materials and resources they received as part of STEM PDs and believed that those resources improved their classrooms and made their classes less chaotic as children had something to play with. It also helped the teachers feel more hands-on and prepared with the activities they wanted to do with children in the class, as they did not need to figure out the availability of materials and resources to plan an activity. According to one of the teachers:

> The more you guys brought in, the less chaotic my class got. Instead of what activity I would come up with today, it was let's go here, let's build this. Children would initiate what they wanted to do, which made a big difference for them and the children.

Another teacher also commented:

> Instead of [TA] and I think of what activity to do--we had to improvise a lot before this project--making a lot of teacher-made activities! At the beginning of the school year, we sent out a list of materials we needed to the parents, but we did not get anything. Thanks to this project, our children received some interesting materials.

As brought up by the EC teachers, having the right materials not only was a benefit, but also, during the STEM PDs they realized how they could turn even the simplest thing into a math, science, engineering, or technology activity. They acknowledged that sometimes teachers forget that children do not necessarily need fancy stuff to learn and get excited about STEM. According to them, having the right preparation, curriculum, resources, and questions to ask the children will intrigue their curiosity. One of the EC teachers explained her experiences as below:

> The extra materials were definitely a plus for the kids, especially the digital cameras. Children loved taking pictures of things we were studying. For example, when we were exploring the topic of living and nonliving, children took photos of different objects in class or on the playground to later label [them] as living or nonliving. For this particular activity, we put the images into a PowerPoint Presentation. During one of our circle times, I played it, and each child would explain their photo and why they thought it was living or nonliving. The children were so proud of their pics, which allowed for a great conversation and many questions to explore further. I loved it when the children would say, "Ms.[teacher], we should explore this [topic or question] more. We can google it to find out…They were excited and pretty much part of the learning process.

Children's Learning

A common theme found in teachers' interviews was the extent and quality of learning that occurred among children. Overwhelmingly, teachers explained that the STEM curriculum offered their students numerous opportunities to be active, engaged, and take the initiative in their own learning. The EC teachers saw a significant association between their content, pedagogical knowledge, and children's learning. They believed the higher the teachers' competence in pedagogical and STEM content knowledge, the greater the students' level of engagement and conversations surrounding the STEM units and activities. As one of the teachers said:

> I think there was a lot of learning going on in the classroom. They [children] were active; they were engaged; they didn't want for it to end. So, it was really nice that this classroom was picked. And these children got to experience it, you know it helped me as a teacher grow, and it helped the children grow as well. Thus, overall, it was GREAT!

The EC teachers also talked about the impact of STEM on children becoming much better thinkers and questioners and paying more attention to how things were working or why they were the way they were, rather than just this is what it is. EC teachers believed that STEM encouraged children to want to know more information, and they asked more questions and tried to find ways to solve those problems. One of the teachers shared:

> I think, not thinking about their scores and what they were tested on, children were much better thinkers. They started asking good questions and then taking those answers and applying them to new experiences. Children started asking more questions. Wanting to work more independently, kind of explore on their own…. The kids wanted to learn!

According to the EC teachers, one of the greatest successes of STEM PDs was the impact they had on the children and the experiences they were able to have. Some teachers shared that even the most impulsive and squirmiest children in their classes were asking good questions and retaining the answers. The teachers could clearly see the content was getting through to them, and they were learning, and I could see it quickly and immediately because they were asking these questions.

> One little boy asked what the word research was because we were doing some research. So, I explained it to him, and the next time we were on the carpet, I asked how could we figure this out, and another kid goes, "we could do some research"! So, it's staying with them, and I think they were learning how to think and figure things out. I think that was the biggest success-even more than what they were learning about the topics.

Some EC teachers also expressed that partnering up with these STEM PDs made their students think outside the box. Before they did any major project, children had learned how to develop their own blueprint, for how they would build it. They also liked the technology part of the PDs as it kept children engaged. I do not know if they played with those types of tools at home. However, they really liked them. Children would help each other with the games if they did not know how to play them. The teachers believed that instead of the teachers having to model

and tell the children what they needed to do, children were able to take ownership of their learning. One of the teachers explained her experiences as below:

> When making a bridge, children at each table worked together and created their blueprint, how many pieces of wood we needed to reach from this part to that part, and what we needed to glue them together. It was a lot of discussion, hands-on, them figuring out vs. us telling them what to do. Here everyone's bridge was different even though we used the same concept. Every bridge was different because they were allowed to show their individuality.

According to the teachers, the STEM integrated curriculum has enabled all children with different abilities to benefit from the content and activities. For the ones at the higher end of learning, it reinforced skills that they already knew, but, more importantly, taught them how to work with and teach their peers needing help. The children at the lower end of the scale made improvements in areas they wouldn't have otherwise without implementing this project. This, according to the teachers, transformed their approach to teaching. Teachers believed the depth given to each lesson helped children learn the material at a deeper level and stay engaged with the materials for a more extended time. One teacher shared:

> Seeing all the children engaged with the materials and content was nice! This year, I had a very active group of children, so I was constantly putting out new materials/activities to keep them "busy and occupied." Instead of focusing on pre-planned themes and introducing fast-paced lessons/activities, I introduced fewer activities with much richer content. Following children's interests, I offered the activities in various modalities so that all children could participate and learn in their own way.

Teachers also shared that the hands-on component and the novelty of the materials [iPads, digital cameras, props, loose parts, etc.] not only helped with learning content but also with some behavioral challenges. To these teachers, the quality and variety of the materials and activities helped children to be more independent, creative, and less confrontational. They showed interest in the activities and had better self-control. This also gave teachers more opportunities to interact with children and facilitate their learning. Children were totally in charge and would share their learning with confidence. Teachers also observed that even those children who would seldom participate in in-group conversation were contributing with much enthusiasm. EC teachers found watching children engage deeply and creatively with the target topics and content exciting and motivating. As one teacher stated:

> So, it was less time spent on managing children's behavior and more time on learning together—Totally a win-win situation! For example, when studying the unit on water, we researched the topic by learning about the water cycle and its importance to living things. Children brainstormed ideas, asked interesting questions, and offered strategies to examine water further. We looked at pictures,

read informational books, asked our local library for other picture books on water, and watched short video clips on the types of water in the ocean, lake, river, marsh, swamp, etc.

Integration Challenges

In their interview, although all EC teachers unequivocally marveled about the benefits of the STEM project, they also shared several challenges in implementing it. As part of the study, teachers were asked to complete reflective journals; collaborate with other teachers to plan if possible; facilitate children's technology use; and document children's learning. However, teachers explained that it was hard to keep up with all these whiles at the same time addressing the goals and assessments required by the state and their school curriculum/curricula. Teachers from Public Pre-K used a combination of curricula, Opening the World of Learning (OWL), Number Worlds, and CIRCLE, whereas teachers from the Head Start program used the Creative Curriculum. Some of the teachers also mentioned that they had children with Individualized Education Programs (IEPs) and some with the high end as far as learning abilities which made it more challenging to get their attention and get them to want to work in a group.

According to one of the teachers:

> It was hard to fully commit to it because of the other things going on. I think it was the time of the year too! The end of the year was hard because students are getting ready to move on and other things going on with testing and parent conferences, wrapping up everything, and planning for the end of the year celebration…

Some teachers also brought up challenges with the technology piece. They shared that the technology piece was attractive to many of the children in the class, but the frequent daily glitches made it challenging to work with it, and they thought that having a technology person available to help with the issues would have been a great help. One of the teachers brought up:

> It was very helpful when someone came to help with the computers because the kids really liked the computers/ iPads. However, we had some mornings that the games on the computers would freeze, and we had to restart it, and the kids had to wait…. They didn't like that. So, it was nice to have someone to help with that.

The teachers also talked about the challenge of whole-class documentation. To these teachers, it was not easy to keep up with the documentation and the school requirements. Sometimes they had to prioritize, and unfortunately, one had to be put aside, and if they did not get to it on the same day, it was hard to pick up where it was left off. As one of the teachers shared:

> The challenge was the documentation piece because sometimes you would be so involved in an activity and you were thinking, Okay, I gotta stop because I have to document this with pictures or, ya know, I gotta write my notes down.

Some teachers talked about having difficulty finding time to collaborate with their colleagues and share STEM ideas in a true sense. They believed such collaboration was

necessary to share, brainstorm and improve one another's work. According to one of the EC teachers:

> We often had various meetings scheduled in the afternoon, so there was not much time left during the school day to really collaborate. Although we are given daily "planning time/prep time," most of the time, they are used for meetings or other tasks than actual planning and/or collaborating. It was wonderful when and if we got to collaborate and plan together! However, those were few and far between. You know…our TAs are asked to drive the bus on some days, or help with the afterschool duties, so we did not even get the chance to reflect and discuss the day's teaching/learning with our own TA.

DISCUSSION

The purpose of this study was to explore the impact of a STEM-integrated professional development program on EC teachers' pedagogical practices and beliefs about teaching STEM curriculum in pre-K settings. The data collected from interviews with early childhood teachers revealed that all EC teachers were positively impacted by the STEM-integrated PD, resources, and the materials available to implement the STEM units. Consequently, children were positively impacted by their teacher's professional learning and high confidence in teaching STEM-related topics and activities. Excerpts and explanations provided by the teachers above are all supported by previous work done by other researchers showing a direct association between the instructional approach of the teacher and children's learning, indicating that children are more likely to learn from teachers with higher levels of instructional competency (e.g., Hamre et al., 2014; Mashburn et al., 2008; Oades-Sese & Li, 2011).

In addition, the findings of this study support that EC teachers' beliefs about what and how young children learn could critically impact children's acquisition of various emergent knowledge and skills in preschool years reported in research by Çiftçi & Topçu (2022) and Margot & Kettler (2019). Opportunities to improve teaching practices (e.g., teacher research), ongoing professional development support (e.g., integrating STEM), administrative policies that provide a democratic and liberated work environment for teachers, and most importantly, teachers' positive self-efficacy to take on challenges would help early childhood teachers constantly reflect back on their beliefs and make more conscious decisions regarding pedagogical issues (Chen et al., 2021). Research support that teachers who are enthusiastic and knowledgeable about STEM concepts play a vital role in enhancing children's learning (Chen et al., 2021; MacDonald et al., 2020). However, many EC educators are apprehensive about incorporating content areas such as math and science, leading to poor student learning outcomes in those areas. Many teachers are reluctant to teach STEM concepts based on opposing views or misconceptions about the subject (C. Campbell et al., 2018; MacDonald et al., 2020). The findings of the present study suggest that frequent high-quality professional development is necessary for both in-

service and preservice teachers. In addition to content knowledge, teachers need to understand and apply pedagogical elements such as gauging student understanding and building on students' knowledge to introduce them to new concepts by carefully planning developmentally appropriate learning goals and objectives.

Empowering young children in STEM also requires the empowerment of the educators who are teaching them. The current need for more STEM curriculum integration is not due to a lack of enthusiasm of the children, parents, or teachers in most cases, but perhaps due to a variety of obstacles that educators might face outside of the programming and resources (Margot & Kettler, 2019). Based on the findings of this study, we include our reflections on factors affecting teachers' pedagogical beliefs about integrating STEM in their classrooms and future directions that need to be taken to make STEM integration in EC curriculums more successful.

Professional Development

Many EC teachers expressed their eagerness to add STEM integrated curriculum to their classroom. However, some teachers also acknowledged the confidence level, preparedness, and support they need to teach STEM topics successfully. Not only can this influence the effectiveness of a new curriculum, but these feelings and assumptions can also be transferred to the children. Growing confident and critical thinkers of young students require having confident STEM mentors to guide them. By providing thorough training, resources, and support, educators can be empowered to lead the classroom with curiosity, excitement, and enthusiasm and pass on these feelings around STEM to their students. Particularly in early childhood education, providing teachers with **hands-on, authentic, and experiential learning experiences** (a very effective learning model for early STEM development) helps them empathize with their students - mirroring their own curious and joyful approach to STEM (Brenneman et al., 2019). Such PDs can also empower educators by sharing STEM content knowledge, developing STEM practices, and building confidence to provide more meaningful STEM experiences for children. Research supports that EC teachers who have STEM teaching experience and relevant PDs reported interests in STEM or participated in STEM-related activities, show higher levels of STEM self-efficacy in terms of cognitive concept, affective attitude, and equipped skill (Chen et al., 2021; MacDonald et al., 2020). Targeted STEM-related PDs also help teachers become inspiring STEM mentors who promote positive attitudes, confidence, and natural curiosity in their classrooms. As a mentor, a teacher can also monitor and balance the right amount of challenges for their students to keep these skills active without overwhelming or discouraging them (Ryu et al., 2019). As mentioned by the EC teachers in this study, they often face their own time and responsibility restrictions that limit their investments in new teaching methods and professional development. By providing the resources for teachers to learn, train on new ideas, and cultivate their own inspiration and enthusiasm, teachers can continue to share that enthusiasm with their students and focus their energy on the classroom.

Building a Web of STEM Learning Resources and Support

During the interviews, the EC teachers shared their perspectives regarding the importance of receiving support to fully implement a STEM-integrated curriculum. Teachers need an ecosystem of enabling resources to implement STEM-integrated curricula successfully. Beyond supplies and materials, activating a network of museums, libraries, and community organizations can contribute to a web-effect of STEM learning and continue to build connections in young children through experiential learning. Many museums and libraries partner with non-profit organizations to bring learning labs and special STEM events to their facilities. Collaborating with community partners and organizations can help build a multi-dimensional infrastructure of experiences for young learners outside of the classroom (Alan et al., 2019). Educators also benefit from having open and receptive communication with school administration to keep the curriculum and its implementation fresh and effective (compelling instead of effective?). Creating an accessible system for teachers to share curriculum ideas with colleagues and administration creates a collaborative environment to continue to grow and succeed with the curriculum. It should also be acknowledged that each school system faces its own unique challenges (DeJarnette, 2018). An integrated STEM curriculum requires appropriate and stimulating materials/resources for teachers as well as children to investigate, problem-solve, design, and test and retest hypotheses. Schools with little to no funds to afford appropriate materials and/or consumable supplies may hinder early childhood teachers from effectively engaging their students with STEM-related activities. Some students have limited technology or internet access at home, and some schools face limited curriculum budgets to incorporate the STEM learning programs they would like for their students. Finding organizations, grants, and opportunities that can assist teachers could be the difference in closing the STEM gap for the next generation (Li et al., 2020).

LIMITATIONS AND RECOMONDATIONS

Some limitations must be considered when evaluating the findings from the current study. The first potential limitation relates to the convenience sampling method used in this study. The participants were volunteers from the STEM curriculum PD project; thus, the participants' characteristics in this study might not represent the general teachers' population. The respondents were drawn from a state-wide population. Considering the small number of participants and the inherent bias in convenience sampling, the sample is unlikely to represent the population being studied, which undermines our ability to generalize from our sample to the population being studied. In regard to another limitation, although the gender and ethnicity of participants are representative of EC teachers' workforce in the field, the lack of representation of other gender and ethnical groups (males and others) in this study should be noted. Future studies should examine or replicate this

study with more participants and different sampling methods. More research, including the EC workforce's perceptions, needs, and perspectives in terms of quality STEM integrated curriculum, would add valuable insight into the potential directions that leadership development should take in the field. Future research also needs to examine other existing EC programs that incorporate STEM integrated curriculums and PDs better understand how they prepare the EC teachers to take on STEM teaching and what direction needs to be taken to make those kinds of preparation programs more effective and available.

CONCLUSION

Engaging in early STEM learning activities can lead to positive academic and developmental outcomes for young children by building on how children learn and explore the world. Empowering young children in STEM requires the empowerment of the educators who are teaching them which highlights the current need for more STEM curriculum integration. In addition to starting STEM concepts early, being consistent, providing proper training and professional development support for educators, and enabling a network of STEM resources for educators, programs and children, this kind of structured curriculum can provide the framework for children to gain a solid foundation in STEM fluency and empower their educators to be inspiring STEM mentors.

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Biographical notes:

Sara Movahedazarhouligh: Dr. Movahedazarhouligh is an Assistant Professor in the Leadership, Policy, and Advocacy for Early Childhood program, in the Department of Early Childhood, Elementary, Middle, Literacy, and Special Education at the University of North Carolina Wilmington (UNCW).

Hengameh Kermani: Dr. Kermani, is an Associate Professor of early childhood education in the Department of Early Childhood, Elementary, Middle, Literacy, and Special Education at the University of North Carolina Wilmington (UNCW).

Jale Aldemir: Dr. Aldemir is an Associate Professor of early childhood education at the New Jersey City University.

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Research

The Effect of The Art Education Status of Gifted Students on Their Professional Preferences

Belgin BAĞRIAÇIK [1] **Serap EMİR** [2]

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Abstract:

This study aims to investigate the effect of gifted students' art education on their professional preferences. The survey model, one of the quantitative research models, was used. A total of 320 students from the Çukurova Science and Art Center art field and general talent field, which were determined by the convenience sampling method, constitute the research sample group. The occupational preference inventory prepared by Atli and Kendal (2017) was used in the research. The inventory comprises six sub-dimensions: investigative, entrepreneurial, artistic, social, realistic, and traditional. Independent Sample t-Test and Anova Test were applied for the analyses, and Cohen's d and Eta Square tests were applied to calculate the effect level in meaningful data. As a result of the research on general talent and art students, it has been determined that there are significant differences in gender, school type, school level, and age.

Keywords: Special Talent, Vocational Choice, Art Education, Professional İnterest.

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[1] PhD, Adana Cukurova Science and Art Center, Adana Turkey. belginyuzgec@hotmail.com,
Orcid ID: 0000-0001-7335-1432

[2] Prof. Dr. Istanbul University- Cerrahpaşa, Education Faculty, İstanbul, Turkey. emirserap@gmail.com,
Orcid ID: 0000-0001-7577-6012

INTRODUCTION

It is important both personally and socially that a person can express himself/herself, that they will not get bored of dealing with it throughout their life, and that he prefers a profession suitable for their personality. It is essential for the individual to choose a profession according to their existing abilities to benefit themselves and the society in which they live because it affects their economic level, social environment, living standard, job satisfaction, and job efficiency. For this reason, choosing a profession is seen as an important turning point in one's life. Selecting a profession that conflicts with the personality traits and interests of the individual negatively affects both their private life and professional life (Aydemir, 2018). The reflection of the individual on their characteristics, interests, training, life experiences, and professional preferences will benefit both themselves and the society they live in (Miller & Cummings, 2009).

Many methods are used to measure the interests of individuals. However, while one of the most preferred methods is inventory application, another is to ask a person directly about their interests. Although it is seen as a conventional method to determine the areas of interest in line with the answers received, it is also possible to reveal the interests by considering the social appreciation (dignity, prestige) against the attitudes related to the job and profession (Kuzgun, 2000). For this reason, inventory and scales should be used in determining interest, where both validity and reliability factors are considered (Herr, Cromer, & Niles, 2004). Holland's (1997) RIASEC professional interest model on identifying professional interests, cognitive abilities, and academic achievement is among the leading models (Vock, Köller, & Nagy, 2013).

Dutch Model of Professional Interest

The vocational Preference Inventory (VPI), initially developed as a short personality test, was primarily used to evaluate professional interests (Gottfredson, 1996). Holland collects the occupational choice inventory in six sub-dimensions. These dimensions were determined as "Realist," "Investigative," "Artistic," "Social," "Entrepreneurial," and "Conventional" (RIASEC). Each type is characterized by a constellation of interests, preferred activities, beliefs, abilities, values, and characteristics. A Holland code (typically the first letters of the RIASEC type that the person most closely resembles) is generated based on evaluations (Nauta, 2010).

Realistic: The realistic dimension is associated with technical and mechanical skills, a dogmatic and practical approach to work, and an interest in working outdoors, with machines or hands. People in this group are more prone to take action than mental activities; they look for logical and concrete solutions while solving problems. They like nature, plants, and animals. Among the professions specific to this type, there are professions such as carpentry, agricultural technicians, and engineering.

Researcher: The researcher includes scientific skills and interests, an intellectual and curious personality, and mathematics and research skills. People in this group enjoy experimenting and observing, researching abstract concepts, and solving problems using analysis synthesis steps. Profession groups that include physics, chemistry, biology, mathematics, and social sciences are among the professions specific to this type.

Artistic: The artistic dimension is associated with innovative and creative features, interests, and skill sets in the arts, including visual and performing arts and creative writing. In addition to the fact that the people in this group have high imagination, developed creative aspects, and can produce original ideas, they have personality traits that work individually rather than in group work and do not like systematic and regular work. Among the professions specific to this type are departments that include fine arts, literature, theater, architecture, and cinema.

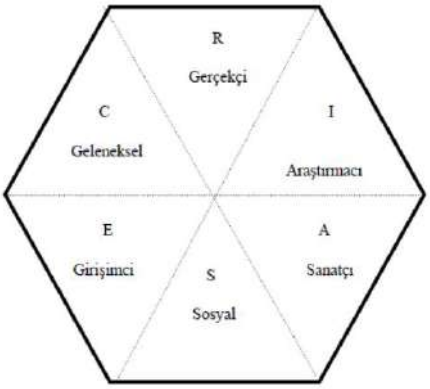
Social: This area is characterized by a social and harmonious attitude, interest in helping others in areas such as teaching or counseling, and interpersonal skills. It can be said that the people in this group like to communicate with people and avoid being involved in mechanical work. As characteristics specific to this area, it is stated that individuals have more humane, sociable, benevolent, and human aspects. Professionals specific to this type include psychologists, teachers, and tourism guides.

Entrepreneur: The entrepreneurial dimension is characterized by an ambitious and dominant personality and leadership skills related to sales, law, and trade; extroverts affect those around them and attach importance to power and prestige. The people in this group have improved leadership characteristics, strong rhetoric, high persuasion skills, and energetic, ambitious, and extroverted characteristics. These individuals enjoy competition and taking risks very much. Occupations such as policy, operator, lawyer, and finance departments can be examples of this type of occupation group.

Traditional: This area is characterized by a systematic and practical approach to work in general, strong office and organizational ability, and conservative values. Individuals have a more traditionally planned structure with certain rules, and enjoy routine work. At the same time, they are individuals with limited imagination, regular, meticulous, and enjoy dealing with numerical data. Among the professions specific to this type, jobs such as accountants, bankers, and office clerks can be given as examples (Holland, 1997).

The closer the types of people are to each other, the higher the harmony between their profession and personality is. While adjacent types of features are called adaptive (e.g., realistic versus traditional; entrepreneur versus social), opposing areas are also referred to as maladaptive (e.g., traditional versus artistic; researcher versus entrepreneur). In addition, according to this theory, people's success in their careers depends on the harmony between their professions and their personalities (Kamaşak and Bulutlar, 2010: 122).

Figure 1. Holland's Occupational Choice Hexagon



Source: (Kamaşık and Bulutlar, 2010: 122)

Even if the individual's professional preferences vary at every age and in every period, their interests or areas of talent play an active role in the profession they want to choose. Many studies have been conducted on occupational preferences from the primary school to university (Flexer, 2008; Bezanson, 2003; Can&Taylı, 2014). Early identification of individuals' interests and orientations is important regarding professional preferences, national added value, social benefit, and individual satisfaction. In particular, it will be beneficial for society to determine the interests of individuals whose particular talent areas are more advanced than their peers and to receive training in this direction. These students are considered more successful than their peers (Gagne, 2003; Sternberg, Jarvin, & Grigerenko, 2010), and the education they need may also differ (Kaya, Ogurlu, & Hizli, 2017).

Special, talented individuals differ from their peers with their metacognitive characteristics (Kail, 2000), intellectual development (Achter, Lubinski, Benbow & Eftekhari-Sanjani, 1999), their ability to comprehend and combine academic and emotional knowledge to solve problems (Gottfredson, 2003). For this reason, they begin to think about their careers earlier than their peers (Kerr and Sodano, 2003; Silverman, 1993). In terms of education and career development, the gifted individual is confronted at a younger age than their peers with the issue that their preferences (i.e., interests and values) are sufficient to produce mature, valid information and can evaluate this information and can help clarify the current complexity (Schmidt, Lubinski, & Benbow, 1998). Some researchers state that intellectually gifted and highly successful students differ from their peers in terms of their intellectual abilities and professional preferences (Stapf, 2003). Specially talented individuals will carry their current potential to the highest level with the training they need in areas or areas for their outstanding talents. When determining the fields of verbal, mathematical, visual, or auditory ability, it is crucial that they have a tendency and interest in the areas (Chen and Wong, 2013). Of course, talent alone is insufficient for positive and

successful vocational training development. However, it is crucial to choose a profession that matches their interests, needs, abilities, and personal life. (Lofquist & Dawis, 1991; Lubinski & Benbow, 2000). In particular, the process is central to success, professional interests, and decision-making for the selected job and post-professional satisfaction. (Gottfredson, 1996). While making a professional choice, the individual is expected to consider their ability in the areas they are interested in and enjoys working in (Chen and Wong, 2013). Previous studies have determined factors such as gender differences (Ferriman, Lubinski, and Benbow, 2009; Kerr and Sodano, 2003) and high potentiality (Achter vd., 1999; Silverman, 1993) affect the occupational preferences of exceptionally talented individuals. Her education, culture, environmental expectations and interests, and abilities are active in her career choices. In addition to determining the individual's area of interest, receiving an education in that area of interest will enable them to develop their interest and ability. With the art education of gifted individuals who are prone to the field of art, it was observed that they developed self-confidence (Bayav, 2007; Koca, 2007), self-esteem (Barış, 2002; Toy, 2006), social skills (Barış, 2008), creative thinking skills (Zimmerman, 2009; Köse, 2006; Keser, 2019), visual perception skills (Carroll, 1987), environmental awareness (Durmuş, 2009) and entrepreneurship characteristics (Mohamed Helmy Elfiel, 2019). Science and Art Centers (BİLSEM) have been established in our country to provide specially talented individuals with the education they need for their field of interest. Individuals with high artistic skills are educated in the areas of "Visual Arts" and "Music," while individuals with interest and skills in mathematics, science, and social sciences are educated in the field of "General Talent" (MEB, 2016). Although, there are studies indicating that the education they receive in BİLSEM affects children's personality development and their skill and talent development in the field they are related to (Sözel, 2019).

In the literature review, there are many studies to determine the professional preferences of individuals with unique talents (Kher-Durlabhji, Lacina-Gifford, Carter, & Lalande, 1997; Kara 2019), the problems they encounter when determining their professional preferences (Kaya, Ogurlu, & Hizli, 2017; Bostan, Bostan, Öztürk &Öztürk, 2020;.), the guidance needed when determining a career (Yusof, Mokhtar, Sulaiman & Mohtar, 2020; Chen & Wong, 2013), the change of professional preferences over the years (Schmidt, Lubinski, & Benbow, 1998), or to investigate the differences between individuals with unique talents and their peers with normal development (Miller & Cummings, 2009; Vock, Köller & Nagy, 2013).However, no study has been found on the effect of the art education status of specially talented individuals on their professional preferences.

The Aim of the Study

The individual's basic skills, characteristics, abilities, and equipment should be considered in occupational preferences. To determine these characteristics of the individual, it was aimed to give an idea to exceptionally talented individuals about their professional

preferences by using the Holland Professional Choice inventory and to determine whether their status of receiving art education from these individuals affects their preferences. For this purpose, answers to the following questions will be sought;

1. Is there a significant difference in the occupational preferences of gifted students according to the field they are diagnosed with?

2. Is there a significant difference in the professional preferences of gifted general and art talent students according to gender?

3. Is there a significant difference in the professional preferences of gifted general and art talent students according to their school levels?

4. Is there a significant difference in the professional preferences of gifted general and art talent students according to age?

5. Is there a significant difference in the professional preferences of gifted general talent students and gifted art talent students according to the type of school?

METHOD

Research Method: The survey model, one of the quantitative research models, was used. According to Karasar (2004), screening models aim to describe a past or present situation as it is. The event, person, or object subject to the research is tried to be defined as it is under its conditions, and no effort is made to change or affect them in any way.

Participants

The convenience sampling method was used in the study. The appropriate sampling method is explained as the selection of the sample from the unit that can be easily applied due to time and labor limitations (Büyüköztürk et al., 2009). A total of 320 students ranging from fifth to twelfth-grade students studying general talent, music, and visual arts at the Adana Science and Art Center make up the study's sample group.35% (112) of the students participating in the study were female in the field of art (SA), 23.1% (74) were female in the field of general talent (GYA), 15% (48) were male in the area of art (SA), and 26.9% (86) were male in the field of general talent (GYA).

Table.1

Demographic Characteristics of the Sample Group

Area of Diagnosis	Female		Male		Total	
	f	%	*f*	%	*f*	%
Artspace	112	35,0	48	15.0	160	50.0

General Capability Area	74	23.1	86	26,9	160	50.0
Total	186	58.1	134	41.9	320	100

Data Collection Tools

In the first part, the researcher creates a personal information form. This form consists of gender, school type, school level, and age variables.

The occupational preference inventory prepared by Atli and Keldal (2017) was used. In the inventory, there are sub-dimensions that determine the 6-person type of realistic, researcher, artistic, social, entrepreneurial, and traditional personality.

Realistic: Technical and mechanical skills are characterized by a dogmatic and practical approach to work and an interest in working outdoors, with machines or hands.

Researcher: Scientific skills and interests are characterized by an intellectual and curious personality and mathematical and research abilities.

Artistic: It is characterized by creative and creative features and a set of interests and skills in the arts, including visual and performing arts and creative writing.

Social: A social and harmonious attitude is characterized by an interest in helping others in areas such as teaching or counseling and interpersonal skills.

Entrepreneur: Characterized by an extroverted, ambitious, and dominant personality and leadership skills in areas of interest in sales, law, and commerce.

Traditional: A systematic and practical approach to work is characterized by solid bureau and organizational capability and conservative values.

The scale consists of 30 items, and a 9-point Likert rating was used. The Cronbach Alpha value of the scale varies between .65 and .85. In the studies using this scale, Cronbach's alpha value was found to be .72 (Bostan, Bostan, Öztürk &Öztürk, 2020). In this study, .78 for the realistic sub-dimension, .81 for the researcher sub-dimension, .74 for the artist sub-dimension, .86 for the social sub-dimension, .84 for the entrepreneur sub-dimension, and .84 for the traditional sub-dimension. In this study, Cronbach's alpha value was found to be 82.

Data Collection and Analysis

Personal information forms and scales were prepared on the form and applied to students, and the data used in the study were obtained. Before the inventory was applied, the researcher created the informative text containing the necessary explanations, and volunteerism was taken as a basis for the study participation. Students were asked to fill in

the items in the inventory according to the most appropriate option. It took a student approximately 20-30 minutes to complete the inventory. Before the study, the number of participants was determined by applying the G Power power analysis test. The statistical analyses to be used in light of the data collected from the participants were determined. A normality test was applied to examine the distribution of the data to determine the analysis of the relationship between the art education status of gifted students and their professional preferences. Correlation analysis was performed with Frequency Distribution Test, Independent Sample t-test, and ANOVA test in normally distributed data. Cohen d and Eta Square values were calculated to determine the effect level.

Ethical consideration

In this study, all rules stated to be followed within the "Higher Education Institutions Scientific Research, and Publication Ethics Directive" scope was observed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics," which is the second part of the directive, was not taken.

Ethical review board name: Istanbul University Cerrahpaşa Scientific Publication Ethics Board

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FINDINGS

This section includes the findings and comments obtained by analyzing the research questions determined.

Table.2

Analysis Table Regarding the Field of Diagnosis and Professional Preferences of Especially Talented Students

		Realistic R	Investigator I	Artistic A	Social S	Enterprising E	Conventional C
Art Field	N	160	160	160	160	160	160
	$\underline{\chi}$	7.33	8.12	9.50	8.54	4.93	3.38
	ss	3.62	3.81	3.29	3.53	3.24	3.02
General Talented Field	N	160	160	160	160	160	160
	$\underline{\chi}$	7.42	8.84	7.66	8.36	4.97	3.99
	ss	3.63	3.88	3.81	3.65	3.30	3.42

According to the results of the analysis made for the first research question, when the field of special talented students' diagnosed and their occupational preferences were examined, it was found that the scoring average of the students in the area of art was high in the artistic, social and research sub-dimensions, and the scoring average of the students in the field of general talent was high in the researcher, social and artistic sub-dimensions (Table.2).

Table. 3

Anova Test Results Regarding Gender and Occupational Preferences of Especially Talented Students

Variable	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	$\|\eta^2$	*Difference*
Realistic	Between Groups	18.948	4	6,316	0.480	.696		
	In-group	4155.799	316	13,151				
	Total	4174.747	320					
Investigator	Between Groups	120.234	4	40.078	2,740	**0.043**	**.024**	**GTF Girl>AF Girl>GTF Boy>AF Boy**
	In-group	4621.654	316	14.625				
	Total	4741.888	320					
Artistic	Between Groups	674.327	4	.776	19.613	**.000**	**.157**	**AF Girl>GTF Girl>AF Boy>GTF Boy**
	In-group	3521.560	316	11.461				
	Total	4295.888	320					
Social	Between Groups	75.481	4	25.160	1.976	.117		
	In-group	4023.719	316	12.733				
	Total	4099.200	320					
Enterprising	Between Groups	2.001	4	0.667	0.062	.980		
	In-group	3393.199	316	10.738				
	Total	3395.200	320					
Conventional	Between Groups	95.370	4	31.790	3.097	**,027**	**.029**	**GTF Boys>AF Boys>GTF**

	In-group	3244.117	316	10,266		**Girls>AF Girls**
	Total	3339.488	320			

Table. 4

Descriptive Statistical Table on Gender and Occupational Preferences of Special Ability Students

	Gender	N	$\underline{\chi}$	ss
	Art Field Girl	112	8.46	3.827
Researcher	General Talented Field Girl	74	9.34	3.833
	Art Field Male	48	7.31	3.685
	General Talented FieldMale	86	8.42	3.888
	TOTAL	320	8.48	3.855
	Art Field Girl	112	10.11	3.085
Artistic	General Talented Field Girl	74	9.05	3.789
	Art Field Male	48	8.08	3.338
	General Talented Field Male	86	6.47	3.419
	TOTAL	320	8.58	3.670
	Art Field Girl	112	3.21	2.749
Conventional	General Talented Field Girl	74	3.35	3.345
	Art Field Male	48	3.75	3.570
	General Talented Field Male	86	4.53	3.412
	TOTAL	320	3.68	3.236

There was no significant difference in the professional preferences of gifted General Talent Field (GTF) students and gifted Art Field (AF) students according to gender in realistic, social and entrepreneurial sub-dimensions (p>.05). In the researcher sub-dimension according to gender in the professional preferences of gifted general talent students and gifted artfield students,024) (p<.05, Table.3). According to the Post Hoc test, this significance was found to be high between the researcher score average of the female students with GTF (© χ= 9.34)and the research score average of the female students with AF (8.46); high between the research score average of the female students with AF (8.46)and the research score average of the male students with GTF (8.42); high between the research score average of the male students with GTF (8.42) and the research score average of the male students with AF (7.31) (Table.4). Again, when the artistic sub-dimension is examined, it is

seen that there iAF moderate (.157). This difference was found to be high between the artistic score average of AF female students (© χ= 10.11) and the artistic score average of AF female students (9.05); high between the artistic score average of AF female students (9.05) and the artistic score average of AF male students (8.08); high between the artistic score average of AF male students (8.08) and the artistic score average of AF male students (6.47) (Table.4). In addition, in the traditional sub-dimension, there is a weak level (.02=029). According to this difference; AF female students' artistic score average (© χ= 10.11) and GTF female students' artistic score average (149.05) were found to be high; AF female students' artistic score average (159.0516) and GTF male students' artistic score average (178.08) were found to be high;19 AF male student' artistic score average (8.08) GTF male students' artistic score average (186.47) were found to be high (Table 4).

Table. 5

Anova Test Results Regarding School Level and Professional Preferences of Special Talented Students

Variable	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	η^2	*Difference*
Realistic	Between Groups	28.739	4	9.580	0.730	**.535**		
	In-group	4146.008	316	13,120				
	Total	4174.747	320					
Investigator	Between Groups	164,504	4	54.835	3,786	**.011**	**0,072**	**GTF Secondary School>AF Secondary School>GTF High School >AF High School**
	In-group	4577.887	316	14.485				
	Total	4741.887	320					
Artistic	Between Groups	356.201	4	118,734	9.524	**.000**	**.074**	**AF High School >AF Secondary School>GTF Secondary School>GTF High School**
	In-group	3939.687	316	12.467				
	Total	4295.888	320					
Social	Between Groups	21.465	4	7.155	0.554	645		
	In-group	4077.735	316	12.904				
	Total	4099.200	320					

Enterprising	Between Groups	142,194	4	47.389	4604	**.004**	**.033**	**AF High School >GTF Secondary School>AF Secondary School>GTF High School**
	In-group	3253.006	316	10.294				
	Total	3395.200	320					
Conventional	Between Groups	61.602	4	20.534	1.980	.117		
	In-group	3277.885	316	10.373				
	Total	3339.487	320					

Table. 6

Descriptive Statistical Table on School Level and Professional Preferences of Special Talented Students

Score	School Level	N	$\underline{\chi}$	sd
Investigator	AF Secondary School	131	8.40	3.745
	GTF Secondary School	124	9.15	3.742
	AF High School	26	6.58	3.818
	GTF High School	39	7.90	4.191
	TOTAL	320	8.48	3.855
Artistic	AF Secondary School	131	9.26	3297
	GTF Secondary School	124	8.20	3.788
	AF High School	26	10.35	3.013
	GTF High School	39	6.33	4.038
	TOTAL	320	8.58	(3,670)
Enterprising	AF Secondary School	131	4.59	3.108
	GTF Secondary School	124	5.40	3.368
	AF High School	26	6.35	3.286
	GTF High School	39	3.82	2.955
	TOTAL	320	4.95	3.262

There was no significant difference in the professional preferences of gifted General Talent Field (GTF) students and gifted Art Field (AF) students in realistic, social and traditional sub-dimensions according to the school level (p>.05). |According to the school

level, there is a weak level in the researcher sub-dimension in the professional preferences of gifted general talent students and gifted art field students (.02=072) (p<.05, Table.5). According to the Post Hoc test, this significance was found to be high between the researcher score average of the secondary school students with GTF (χ= 9.15) and the research score average of the secondary school students with AF (8.40); high between the research score average of the secondary school students with AF (8.40)and the research score average of the high school students with GTF (7.90); high between the research score average of the high school students with GTF (7.90) and the research score average of the high school students with AF () (Table.6). Again, when the artistic sub-dimension is examined, it is seen that there iAF low level of 074). This difference was found to be high between the artistic score average of AF high school students (χ= 10.35) and the artistic score average of AF secondary school students (9.26); high between the artistic score average of AF secondary school students (9.26) and the artistic score average of GTA secondary school students (8.20); high between the artistic score average of GTF secondary school students (8.20) and the artistic score average of GTF high school students (6.33) (Table.6). In addition, a low level of significance was found in the entrepreneur sub-dimension (p<.05, Table.6). Accordingly, it was determined that the mean entrepreneurial score of AF high school students was high (χ= 6.35) and the meanentrepreneurial score of GTF secondary school students was high (5.40); the mean entrepreneurial score of GTF secondary school students was high (5.40) and the mean entrepreneurial score of AF secondary school students was high (4.59); the mean entrepreneurial score of AF secondary school students was high (4.59) and the mean entrepreneurial score of GTF high school students was high (3.82) (Table.6).

Table. 7

Anova Test Results Regarding the Age Levels and Professional Preferences of Especially Talented Students

Variable	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	η^2	*Difference*
Realistic	Between Groups	77.511	6	37.483	1.188	.315	.045	
	In-group	4097.236	314	12.699				
	Total	4174.747	320					
Investigator	Between Groups	188.834	6	37,767	2.605	**,025**	**.062**	GTF 12-14 Years>GTF 10-11 Years>AF 10-11 Years>AF 12-14 Years>GTF 15-17 Years>AF
	In-group	4553.053	314	14,500				
	Total	4741.888	320					

								15-17 Years
Artistic	Between Groups	384.194	6	76.839	6.168	**.000**	**.079**	AF 15-17 Years old>AF 12-14 Years old>AF 10-11 Years old>GTF 12-14 Years old>GTF 10-11 Years old>GTF 15-17 Years old
	In-group	3911.694	314	12,458				
	Total	4295.888	320					
Social	Between Groups	18.618	6	3.724	0.287	.920		
	In-group	4080.582	314	12.995				
	Total	4099.200	320					
Enterprising	Between Groups	112.160	6	22.432	2.145	.060		
	In-group	3283.040	314	10.456				
	Total	3395.200	320					
Conventional	Between Groups	83.411	6	16.682	1.609	.157		
	In-group	3256.076	314	10,370				
	Total	3339.487	320					

Table. 8

Descriptive Statistical Table on Age Levels and Occupational Preferences of Special Ability Students

Score	Age Level	N	$\overline{\chi}$	sd
Investigator	AF 10-11 Years	68	8.71	3.856
	GTF 10-11 Years	86	8.90	3,505
	AF 12-14 Years	56	8.02	3.430
	GTF 12-14 Years	36	9.86	4.223

	AF 15-17 Years	35	7.00	4.109
	GTF 15-17 Years	39	7.90	4.191
	TOTAL	320	8.48	3.855
Artistic	AF 10-11 Years	68	9.21	3.258
	GTF 10-11 Years	86	7.97	3.546
	AF 12-14 Years	56	: 9.45	3.379
	GTF 12-14 Years	36	8.44	4.212
	AF 15-17 Years	35	10.14.	(3.246)
	GTF 15-17 Years	39	6.33	3.716
	TOTAL	320	8.58	(3,670)

As an answer to another research question, no significant difference was found in the professional preferences of gifted General Talent Field (GTF) students and gifted Art Field (AF) students according to their age level in realistic, social, entrepreneurial and traditional sub-dimensions (p>.05). According to the school level, there is a weak level in the researcher sub-dimension in the professional preferences of gifted general talent students and gifted art field students (.02=072) (p<.05, Table.7). According to the Post Hoc test, this significance was found to be high between the researcher score average of the students aged 12-14 years (© χ= 9.86) and the research score average of the students aged 10-11 years (); high between the research score average of the students aged 10-11years (8.90) and the research score average of the students aged 10-11 years (8.71); high between the research score average of the students aged 10-11 years (8.71) and the research score average of the students aged 12-14 years (); high between the research score average of the students aged 12-14 years (8.02) and the research score average of the students aged 15-17 years (); high between the research score average of the students aged 15-17 years (7.90) and the research score average of the students aged 15-17 years (Table).8). Again, when the artistic sub-dimension is examined, it is seen that there is a low level of.

This difference was found to be high between the artistic score average of AF 15-17 years old students (© χ= 10.14) and the artistic score average of AF 12-14 years old students (9.45); high between the artistic score average of AF 12-14 years old students (9.45) and the artistic score average of AF 10-11 years old students (9.21); high between the artistic score average of AF 10-11 years old students (9.21) and the artistic score average of AF 10-11 years old students (8.44); high between the artistic score average of AF 12-14 years old students () and the artistic score average of GTF 10-11 years old students (7.97); high between the artistic score average of GTA 10-11 years old students (7.97) and the artistic score average of GTF 15-17 years old students (6.33) (Table).8).

Table.9

Anova Test Results Regarding the Type of School and Professional Preferences of Special Talented Students

Variable	Source of Variance	Sum of Squares	sd	Mean of Squares	F	p	$\|\eta^2$	*Difference*
Realistic	Between Groups	39.063	4	13.021	(0.995)	395		
	In-group	4135.684	316	13088				
	Total	4174.747	320					
Investigator	Between Groups	89.894	4	29.965	2.035	.109		
	In-group	4651.993	316	14.721				
	Total	4741.888	320					
Artistic	Between Groups	277.176	4	92.392	7.265	**.000**	**.065**	AF Private School>AF Public School>GT F Private School>GT F Public School
	In-group	4018.711	316	12.717				
	Total	4295.888	320					
Social	Between Groups	22.617	4	7.539	0.584	.626		
	In-group	4076.583	316	12.901				
	Total	4099.200	320					
Enterprising	Between Groups	29.275	4	9.758	0.916	0.433		
	In-group	3365.925	316	10.652				
	Total	3395.200	320					
Conventional	Between Groups	49.640	4	16.547	1.589	192		
	In-group	3289.847	316	10.411				
	Total	3339.487	320					

Table. 10

Descriptive Statistical Table on School Type and Professional Preferences of Special Talented Students

Score	School Type	N	$\underline{\chi}$	sd
Artistic	state school	75	9.41	3.133
	state school	70	7.44	3.933
	AF Private School	85	9.58	3.434
	GTF Private School	90	7.83	3.724
	TOTAL	320	8.58	(3,670)

As an answer to the last research question; no significant difference was found in the professional preferences of gifted General Talent Field (GTF) students and gifted Art Field (AF) students according to school type; realistic, researcher, social, entrepreneurial, and traditional sub-dimensions (p>.05, Table.9). However, when we look at the artistic sub-dimension, it is seen that there is a low level of 074). This difference was found to be high between the artistic score average of the AF private school students (© χ = 9.58) and the artistic score average of the AF public school students (9.41); high between the artistic score average of the AF public school students (9.41)and the artistic score average of the GTF private school students (7.83); high between the artistic score average of the GTF private school students (7.83) and the artistic score average of the GTF public school students (7.44) (Table 10).

CONCLUSION AND DISCUSSION

In studies investigating the effect of art education on the individual, there are three different opinions cognitive approach, psychological approach, and self-developmental approach. While the cognitive approach explains the use of art in the evaluation of children's knowledge about the changing world, the psychological approach explains art as the reflection of the inner worlds of individuals. In the third approach, art education is where individuals establish a relationship with the society they are in, understand their self-development, and become a tool for communicating with society (Zimmerman and Zimmerman, 2000).

Art aims to reveal the meaning in the content of the work, not to define it by the appearance of the resulting products. Art stimulates entrepreneurship and independence feelings in the individual. The work of art is expected to be original. Art education aims to educate tastes and emotions, to create a perspective towards a beautiful work, and to give an aesthetic view to every stage of daily life. Art should be included in the educational process of each individual starting from preschool, not only for being a profession but also

with or without special abilities (Aral, 1999). Interest and skill areas and life experiences play a significant role in the professional preferences of individuals. If the individual realizes these areas early, it will also make it easier for him/her to direct their life. The gifted individual begins to research the profession they want to do before their peers (Schmidt, Lubinski, & Benbow, 1998). They need differentiated or enriched education to develop their areas of interest. Providing these children with the education they need from an early age is seen as a national gain (Madeja, 1983). Even if the field in which the child is diagnosed is different, their education about any of the branches of art during their education will provide them with an aesthetic perspective, and socialization, explore the entrepreneurial spirit, and develop their artistic ability, if any (Hurwitz, 1983).

Conclusions Regarding the Research Question

Science and Art Centers are the leading institutions that provide education to gifted students in our country. In these institutions, the student receives training only in the field they are diagnosed in. While students diagnosed in the area of General Talent are studying in the fields of social sciences, science, and mathematics, students diagnosed in art receive only music or visual arts education. Considering the field of diagnosis and professional interests of these students, it was seen that the mean score of the students in the field of art was high in the artistic, social, and research sub-dimensions, and the mean score of the students in the area of general talent was high in the researcher, social and artistic sub-dimensions. When the results are examined, it is seen that there are common sub-dimensions in both areas. The fact that gifted students are curious, research-loving, questioning, and sensitive to their environment and the society they live in is compatible with the researcher and social sub-dimension, and the fact that they are sensitive, idealistic, aesthetic, emotional, introverted, and creative is compatible with the artistic sub-dimension (Yusof, Mokhtar, Sulaiman and Mohtar, 2020). On the other hand, the study showed that the entrepreneurship sub-dimension had the lowest mean score in both areas. Similar results in the literature.

Conclusions Regarding the Research Question

When examined according to genders, it was seen that in the researcher sub-dimension, female students in the field of general talent had the highest mean score, followed by female students in the field of art, male students in the field of general talent and male students in the field of art, respectively. In their study, Webb ve diğ(2002) found that gifted female students had more investigative characteristics than male students. In another dimension of art, female students in the art field have the highest mean score. In contrast, the mean scores of female students in the general talent field, male students in the art field and male students in the general talent field are observed, respectively. In the traditional sub-dimension, the highest average score of male students in the general talent

area is seen. Then, the art field is listed for male students, the general talent field as female students, and the art field as female students.

Conclusions Regarding the Research Question

According to the school level, the mean scores of secondary school students in the field of general talent, secondary school students in the field of art, high school students in the field of art, and high school students in the field of general talent are ranked in the research sub-dimension. Similarly, when the age levels were examined, it was determined that the students between the ages of 12-14 had the highest general ability, and the students between the ages of 15-17 had the lowest average score in the research sub-dimension. It is seen that as the students' school level or age level increases, there is a decrease in the direction of the researcher. Future anxiety is gradually moving away from the questioning student model due to the anxiety of being able to settle in the university (Kumandaş and Kutlu, 2014). In the artistic sub-dimension, the average score of high school students in art is the highest. Afterward, secondary school scores in the field of art, a secondary school in the field of general talent, and high school scores in general talent are listed. The artistic score of the student receiving art education increases, and the artistic score of the student who does not receive art education decreases as the school level increases. The student's art education changes their creativity, imagination, and perspective towards events as well as the development of their artistic ability (Zimmerman, 2009). The highest average score in the entrepreneurship sub-dimension is seen in high school students in the art field. Then, the mean scores of secondary school students in general talent, secondary school students in the art field, and high school students in the general talent field are respectively followed. In his study, Shavinina (2008) defined the characteristics of the gifted entrepreneurial individual as; innovative, creative, capable of working independently, not afraid of difficulties, perfectionist, and not like to be bound by rules. On the other hand, Lena and Lindemann (2014) defined the artist as a creative, perfectionist person who enjoys working independently and producing original works. It can be interpreted that the state of the gifted student's art education affects the entrepreneurship aspect.

Conclusions Regarding the Research Question

In the artistic sub-dimension, it was determined that the student between the ages of 15-17 had the highest mean score, and the student between the ages of 15-17 had the lowest mean score. According to the "maturation theory" developed by Arnold Gesell et al., children are born with some innate abilities, and their abilities begin to emerge as they mature. (Ulutaş, Ersoy, 2004). In this process, education is of great importance. If a suitable environment is created for the child and the right people can guide them, they can develop their talent. These are intense feelings of aesthetics and creativity. Supporting it in the early period will be productive, creative individuals who understand and perceive the beauties in the environment (Feeney and Moravcik, 1987). Lowenfield (1947) and Gardner (1980) reported that when adults are not given the necessary support and equipment, their artistic

abilities will be blunted, and at the same time, their inner skills will be lost if they intervene too much about the product offered by an adult (Ulutaş, Ersoy, 2004).

Conclusions Regarding the Research Question

Significant differences were observed only in the artistic sub-dimension when the school types of gifted students were examined. Accordingly, private school students diagnosed from the art field with the highest average score, then the average score of public school students diagnosed from the art field, the average score of private school students diagnosed from the general talent field, and the average score of students going to the diagnosed public school from the general talent field, respectively. It is thought that one of the reasons for this difference is that art lessons are taught by classroom teachers at the primary school level in public schools affiliated with the Ministry of National Education, and art lessons are taught by art teachers in private schools. Students attending the Science and Art Center support the elimination of deficiencies by receiving the art education they need in these centers, whether their formal education is private or public school.

In general, the fact that gifted students receive art education has led to the development of their artistic, entrepreneurial, and social aspects.

RECOMMENDATIONS

Based on the survey results;

- Investigation of the factors underlying the vocational choices of gifted students, the overlap between the professions they want to choose and their interests, and the interests and professional preferences of students graduating from Science and Art Centers,
- Organizing information seminars for gifted students on professional promotion days and what they should pay attention to in their professional preferences,
- Organizing training on the professional preferences of exceptionally talented students for their teachers and parents,
- It is recommended that art education courses be held by art teachers in public schools affiliated with the Ministry of National Education.

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Biographical notes:

Belgin BAĞRIAÇIK: She completed her undergraduate education in Selçuk University Music Education Department and her master's degree in Necmettin Erbakan Music Education Department. She is currently a PhD student at Istanbul University-Cerrahpaşa Education of Special Talents Programme. She is a music teacher at Adana Çukurova Science and Art Center.

*Prof. Dr. Serap EMİR***:** EMİR, who started her academic life at Abant İzzet Baysal University in 1997, has been the head of Hasan Ali Yücel Education Faculty, Special Education Department, Special Talented Education Department since 2018.

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Research

Ethnic/Racial Differences in Mathematics Performance of Texas Grade 3 Students: A Statewide, Multiyear Study [1]

Gaylon Davenport [2] **John R. Slate** [3]

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Abstract:

Write a short summary of the article in English here. The "Abstract" you will write In this investigation, the extent to which differences were present in the mathematics achievement by the ethnicity/race of Grade 3 students in Texas were analyzed. Data obtained from the Texas Education Agency Public Education Information Management System for all Texas Grade 3 students who took the State of Texas Assessment of Academic Readiness Mathematics exam were examined for the 2016-2017, 2017-2018, and 2018-2019 school years. In all three years analyzed, statistically significant differences were revealed in overall mathematics achievement and in all four Mathematics Reporting categories. Inferential statistical analyses revealed a clear stair-step effect. Asian students were the highest performing ethnic/racial group in all four Mathematics Reporting categories and all three performance level standards, followed by White, Hispanic, and Black students. Suggestions for future research and implications for policy and practice were provided.

Keywords: Mathematics achievement, Ethnicity/race, STAAR Grade 3, Texas.

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[2] Dr. Gaylon Davenport, Graduate of the Educational Leadership Doctoral Program, Sam Houston State University, Huntsville, TX USA profslate@netscape.net, Orcid ID: https://orcid.org/0000-0001-9915-7849

[3] Dr. John R. Slate, Full Profesor, Department of Educational Leadership, Sam Houston State University, Huntsville, TX USA jrs051@shsu.edy, Orcid ID: https://orcid.org/0000-0001-9915-7849

INTRODUCTION

In 2001, the United States Department of Education passed the No Child Left Behind Act in which states and school districts were required to report the progress they were making on closing ethnic/racial achievement gaps (U.S. Department of Education, 2005). A focus was placed on closing the White-Black and White-Hispanic achievement gaps in the content areas of reading and mathematics. In 2015, a new education policy, the Every Students Succeeds Act, was enacted with mandates of a continued focus on the narrowing of achievement gaps. Maintained in this new law was state and school district accountability to continue to work toward closing racial/ethnic achievement gaps (U.S. Department of Education, 2017). Despite policies targeted at closing these achievement gaps, many researchers (e.g., Braun, Chapman, & Vezzu, 2010; Growe & Montgomery, 2003; Reardon, Cimpian, & Weathers, 2015; Reardon & Galindo, 2009; Reardon, Kalogrides, & Shores, 2019; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009) have established that the achievement gap is not closing at an appropriate rate. In fact, researchers (e.g., Fryer & Levitt, 2006; Kuhfeld, Gershoff, & Paschall, 2018; Lee & Burkham, 2002; McDonough, 2015; Reardon, 2011) have documented how students of color enter school with disparities which continue to be present as children progress through school.

Also mandated in the previously mentioned federal laws were that state education leaders and school practitioners must disaggregate student assessment data to ensure all student groups are mastering the content. According to the Nation's Report Card (2019a), only 41% of Grade 4 students in the United States were at or above the proficient level on the National Assessment of Educational Progress Mathematics assessment. Within that percentage, 70% were Asian, 52% were White, 27% were Hispanic, and 20% were Black (The Nation's Report Card, 2019a). These percentages are congruent with previous researchers (e.g., Harris, 2018; Jencks & Phillips, 1998; Lee, 2002; McGown, 2016; Reardon & Galindo, 2009; Saw & Chang, 2018; Schleeter, 2017) who established that Asian students had the highest test scores, followed by White students, Hispanic students, and then Black students in mathematics. These data are indicative of a 32% gap between White and Black students and a 25% gap between White and Hispanic students. Compared to 2009, the White-Black achievement gap and the White-Hispanic achievement gap decreased three and four percentage points, respectively, over 10 years (The Nation's Report Card, 2019a). In Grade 8, one third of the students in the United States were at or above proficient on the National Assessment of Educational Progress Mathematics assessment (The Nation's Report Card, 2019b). Of those students, 64% were Asian, 44% were White, 20% were Hispanic, and 14% were Black. The White-Black and White-Hispanic achievement gaps present for Grade 8 students were almost identical to the gaps present for Grade 4 students.

With regard to the state of interest in this study, Texas, achievement gaps by ethnicity/race in reading have been well documented. In 2018, Harris addressed the presence of ethnic/racial differences in the reading performance of Texas Grade 4 students.

Analyzed in her study were three years of data (i.e., 2012-2013, 2013-2014, 2014-2015) from the state-mandated reading assessment, the State of Texas Assessment of Academic Readiness (STAAR) Reading exam, to determine whether ethnic/racial (i.e., Asian, Black, Hispanic, and White) differences were present. In her study, statistically significant ethnic/racial achievement gaps were present in reading for all three school years. Regarding the three reading reporting categories, Asian students outperformed White, Hispanic, and Black students (Harris, 2018). Similarly, White students outperformed Hispanic and Black students. In all three STAAR Reading Reporting categories, Hispanic students had higher reading test scores than their Black peers. With respect to passing rates, Harris (2018) also documented that Asian students had the highest passing rates on the STAAR Level II Final Satisfactory Performance Standard in reading, followed by White students, Hispanic students, and then Black students. Consistent with the national scores previously discussed, racial/ethnic achievement gaps in reading were clearly present on the Texas state-mandated assessment for Grade 4 students.

McGown (2016) conducted a similar study of Texas Grade 3 students. She analyzed the Texas state-mandated reading assessment for the same three school years (i.e., 2012-2013, 2013-2014, 2014-2015) as Harris (2018), with the difference being that her sample consisted of Grade 3 students and the Harris study sample were Grade 4 students. Established in the McGown (2016) investigation were the presence of statistically significant ethnic/racial differences in reading. Similar to Harris (2018), statistically significant differences were present for all four student groups. Regarding the three STAAR Reading Reporting categories, Asian students outperformed White, Hispanic, and Black students (McGown, 2016). Similarly, White students outperformed Hispanic and Black students. In all STAAR Reading Reporting categories, Hispanic students had higher reading test scores than their Black peers. With respect to passing rates, McGown (2016) also determined that Asian students had the highest passing rates on the STAAR Level II Final Satisfactory Performance Standard in reading, followed by White students, Hispanic students, and then Black students. Consistent with the national scores previously discussed and with the Harris (2018) investigation on Grade 4 students, racial/ethnic achievement gaps in reading were clearly present on the Texas state-mandated assessment for Grade 3 students.

In another study conducted in Texas, Schleeter (2017) addressed differences in reading achievement by the ethnicity/race of Grade 3 English Language Learners. Analyzed in his study were the same three school years of data (i.e., 2012-2013, 2013-2014, 2014-2015) as Harris (2018) and McGown (2016) from the Texas state-mandated reading assessment. Similar to Harris (2018) and McGown (2016), statistically significant differences were present for all four student groups. Regarding all three school years, Asian English Language Learners outperformed White English Language Learners, followed by Black English Language Learners, and then Hispanic English Language Learners (Schleeter, 2017).

As of this investigation, only one published article was located in which performance on the Texas state-mandated assessment in mathematics was addressed. In that article, Davenport and Slate (2019) analyzed the degree to which differences were present in the STAAR Mathematics performance of Texas Grade 3 students by their economic status (i.e., Not Poor, Moderately Poor, and Extremely Poor) at the Approaches Grade Level, Meets Grade Level, and Masters Grade Level performance standards. Grade 3 students who were Not Poor had the highest passing rates on the Approaches Grade Level performance level, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. A clear stair-step effect (Carpenter, Ramirez, & Severn, 2006) was present at the Approaches Grade Level performance level. Similarly, at the Meets Grade Level performance level, Grade 3 students who were Not Poor had the highest passing rates, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. Finally, for the Masters Grade Level performance level, Grade 3 students who were Not Poor had the highest passing rates, followed by the Moderately Poor group, and then by Grade 3 students who were Extremely Poor. Thus, at all three indicators of mathematics performance, a stair-step effect (Carpenter et al., 2006) was present, with respect to economic status. The highest passing rates were consistently present for students who were not in poverty; the next best passing rates were present for students who were eligible for the reduced-price lunch program; and the lowest passing rates were present for students who were eligible for the free lunch program.

In a comprehensive analysis of the previous Texas state-mandated assessment, the Texas Assessment of Knowledge and Skills, Alford-Stephens (2016) analyzed the mathematics performance of Texas high school boys by their ethnicity/race (i.e., Asian, Black, Hispanic, and White). She analyzed data from the 2004-2005 through the 2011-2012 school years. In her multiyear, statewide analyses, she documented the presence of statistically significant ethnic/racial differences in mathematics performance in each of the eight school years examined. Throughout the 8-year time period, Asian boys had the highest met standard percentage, followed by White boys. White boys had a higher met standard percentage than Hispanic boys and Black boys. For all eight years analyzed, Black boys had the lowest met standard percentage. A stair-step effect (Carpenter et al., 2006) was present, with respect to ethnicity/race at the met standard proficiency level. These findings were consistent with previous literature of ethnic/racial achievement gaps in mathematics.

Statement of the Problem

Since the United States Supreme Court decision in Brown vs. The Board of Education of Topeka, education has been viewed as a way for all individuals, regardless of their background, to succeed in life (Colleen & Carlos, 2001). However, researchers (e.g., Barton & Coley, 2010; Paschall, Gershoff, & Kuhfeld, 2018) have established achievement gaps based on ethnicity/race are still present, although some researchers (e.g., Burchinal et al.,

2011; Reardon & Portilla, 2016) have discussed how gains have been made that have resulted in slight decreases in the gaps from 1998 to 2010. Reardon and Galindo (2009) reported the gaps in achievement between White and Hispanic students were narrowing at a faster pace than the gaps between White and Black students. Documented in the 2019 Nation's Report Card was a mathematics achievement gap of 32 percentage points between White and Black students in Grade 4 and a 24 percentage point gap between White and Hispanic students in Grade 4.

The State of Texas gives school campuses and school districts accountability scores on their closing of achievement gaps between the subpopulations they serve (Texas Education Agency, 2019). Researchers (e.g., Alford-Stephens, 2016; Harris, 2018; McGown, 2016; Schleeter, 2017) have established the presence of achievement gaps in Texas which are consistent with national research on ethnic/racial achievement gaps in that Asian and White students are achieving at a higher level than their peers who are Black and Hispanic in the area of reading. An extensive search of the extant research literature, however, revealed the presence of only one published article (Davenport & Slate, 2019) on the mathematics performance of Texas students.

Purpose of the Study

The purpose of this study was to determine the degree to which ethnicity/race (i.e., Asian, Black, Hispanic, and White) of Texas Grade 3 students is related to their mathematics performance. Specifically addressed herein was the degree to which differences were present by the ethnicity/race of Texas Grade 3 students on the STAAR Mathematics Reporting Categories. Also examined was the extent to which ethnic/racial differences existed in the percentages of Texas Grade 3 students achieving at the three performance levels (i.e., Approaches Grade Level, Meets Grade Level, and Masters Grade Level). The final purpose of this study was to determine if any trends were present in the reporting categories and performance levels across three school years (i.e. 2016-2017, 2017-2018, 2018-2019) by the ethnicity/race of Texas Grade 3 students.

Significance of the Study

Prior researchers (e.g., Harris, 2018; McGown, 2016; Schleeter, 2017) have documented the presence of statistically significant differences in the reading performance of Texas students on the state-mandated assessment over a 3-year time period. Alford-Stephens (2016) established ethnic/racial differences in the mathematics performance of Texas students on the previously used state-mandated assessment over an 8-year time period. Currently, the published research literature regarding the mathematics performance of Texas students by ethnicity/race on the current state-mandated assessment is minimal. Findings from this study can increase the literature on this topic. In addition, policymakers and practitioners can use these findings to understand how students from different ethnic/racial backgrounds learn and understand different mathematical concepts.

Research Questions

In this study, the following overarching research question was addressed: What is the difference in mathematics performance by the ethnicity/race (i.e., Asian, White, Hispanic, and Black) of Texas Grade 3 students? Specific subquestions under this overarching research question were: (a) What is the difference in numerical representations and relationships by the ethnicity/race of Texas Grade 3 students?; (b) What is the difference in computations and algebraic relationships by the ethnicity/race of Texas Grade 3 students?; (c) What is the difference in geometry and measurement by the ethnicity/race of Texas Grade 3 students?; (d) What is the difference in data analysis and personal financial literacy by the ethnicity/race of Texas Grade 3 students?; (e) What is the difference in performance on the Approaches Grade Level standard by the ethnicity/race of Texas Grade 3 students?; (f) What is the difference in performance on the Meets Grade Level standard by the ethnicity/race of Texas Grade 3 students?; (g) What is the difference in performance on the Masters Grade Level standard by the ethnicity/race of Texas Grade 3 students?; and (h) What is the degree to which trends are present in mathematics by the ethnicity/race of Texas Grade 3 students? The first seven research subquestions were addressed for three school years, whereas the last research question involved a comparison of results across all three school years.

METHOD

Research Design

For this study, the research design was a quantitative, non-experimental, causal comparative (Johnson & Christensen, 2020). Because the independent variables and dependent variables had already taken place, a causal comparative design was used to find relationships between independent and dependent variables (Johnson & Christensen, 2020). In this study, the mathematics achievement of Grade 3 students in Texas was analyzed to determine the extent to which ethnic/racial differences might be present. The independent variable in this study is the ethnicity/race (i.e., Asian, White, Hispanic, Black) of Grade 3 students in Texas. The dependent variables in this study were the STAAR Mathematics Reporting Categories (i.e., Reporting Category 1, Reporting Category 2, Reporting Category 3, and Reporting Category 4) and the three STAAR Mathematics performance levels (i.e., Approaches Grade Level, Meets Grade Level, Masters Grade Level) for Grade 3 Students in Texas.

Participants and Instrumentation

Participants in this study were Grade 3 students in Texas who had taken the STAAR Mathematics assessment during the 2016-2017, 2017-2018, and 2018-2019 school years. Data were requested from the Texas Education Agency Public Education Information Management System. Analyses were conducted based on student ethnicity/race (i.e., Asian, White, Hispanic, Black), performance level (i.e., Approaches Grade Level, Meets Grade Level, Masters Grade Level), and across the four STAAR Mathematics Reporting Categories

(i.e. Reporting Category 1, Reporting Category 2, Reporting Category 3, and Reporting Category 4).

Mathematics achievement was determined based on the four STAAR Mathematics Reporting Categories. In Reporting Category 1, students are assessed over their ability to understand numerical representations and relationships. STAAR Mathematics Reporting Category 2 measures student ability to understand algebraic relationships and computations. Assessed in Reporting Category 3 is the ability for students to understand geometry and measurement. Finally, in Reporting Category 4, student ability to understand data analysis and financial literacy is measured.

In addition to the STAAR Mathematics Reporting Categories, three performance level standards were analyzed in this study. In 2017, the Texas Education Agency introduced three performance levels to determine how well students performed on the STAAR Mathematics Assessment (Texas Education Agency, 2017). The Approaches Grade Level standard predicts that students will be likely to succeed in the next grade level or course with targeted academic interventions to assist in the student's academic progress (Texas Education Agency, 2017). In the Meets Grade Level standard, students will be expected to succeed in the next grade level with some form of short-term, targeted academic interventions. Students who perform in the Masters Grade Level standard are expected to succeed in the next grade level. The students in this category will need very little to no academic intervention (Texas Education Agency, 2017).

Readers are directed to the Texas Education Agency website (www.tea.gov) for detailed information about the test reliabilities and test validities of the STAAR Mathematics exam. Extensive documentation is present there of strong test reliabilities and of strong correlations (i.e., test validities) for this STAAR exam with other measures.

Ethical Considerations

Only archival, pre-existing data were analyzed in this multiyear investigation. The Texas Education Agency that provided the data to the authors of this study first de-identified all student data so that no students could be identified. Accordingly, no ethical risks or harm was possible from conducting this investigation.

RESULTS

Prior to conducting multivariate analysis of variance (MANOVA) statistical procedures, its underlying assumptions were checked. Specifically examined were data normality, Box's Test of Equality of Covariance and the Levene's Test of Equality of Error Variance. Although a majority of these assumptions were not met, the robustness of the MANOVA procedure made it appropriate to use in this study (Field, 2009). Results of statistical analyses by the ethnicity/race of Grade 3 students in Texas who took the STAAR

Mathematics assessment will be described by Mathematics Reporting Category in chronological order for the 2016-2017, 2017-2018, and 2018-2019 school years.

Overall Results Across All Three School Years

With respect to the 2016-2017 school year, the MANOVA revealed a statistically significant difference in overall mathematics performance by the ethnicity/race of Texas Grade 3 students, Wilks' $\Lambda = .90$, $p < .001$, partial $\eta^2 = .04$, small effect size (Cohen, 1998). Regarding the 2017-2018 school year, the MANOVA yielded a statistically significant difference, Wilks' $\Lambda = .88$, $p < .001$, partial $\eta^2 = .04$, in overall mathematics performance as a function of student ethnicity/race. According to Cohen (1988), the effect size for this statistically significant difference was small. Concerning the 2018-2019 school year, a statistically significant difference was again present in overall mathematics performance, Wilks' $\Lambda = .87$, $p < .001$, partial $\eta^2 = .04$. Using Cohen's (1988) criteria, the effect size was small. In all three school years, effect sizes were small for the statistically significant differences in overall mathematics performance of Texas Grade 3 students by their ethnicity/race.

Mathematics Reporting Category 1 Results Across All Three School Years

Following the overall results of the MANOVA, univariate follow-up Analysis of Variance (ANOVA) procedures were calculated to determine whether statistically significant differences were present in STAAR Mathematics Reporting Category 1 scores by student ethnicity/race for all three school years. Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 212283) = 6662.25$, $p < .001$, partial $\eta^2 = .09$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 176326) = 5166.69$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 1 by ethnicity/race, $F(2, 165811) = 5946.50$, $p < .001$, partial $\eta^2 = .10$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 1, the effect sizes for the statistically significant differences on the STAAR Mathematics Reporting Category 1 by ethnicity/race were moderate for all three school years.

To determine which ethnic/racial pairings were statistically significantly different, Scheffe' post hoc procedures were conducted. Statistically significant differences on the STAAR Mathematics Reporting Category 1 were revealed for all of the ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.72 more items correctly than White students, 1.68 more items correctly than Hispanic students, and 2.31 more items correctly than Black students. Similarly, White students answered 0.96 more items correctly than Hispanic students and 1.59 more items correctly than Black students. Hispanic students answered 0.63 more items correctly, on average, than Black students.

Black students were the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.60 more items correctly than White students, 1.42 more items correctly than Hispanic students, and 2.11 more items correctly than Black students. Similarly, White students answered 0.82 more items correctly than Hispanic students and 1.51 more items correctly than Black students. Hispanic students answered 0.68 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.70 more items correctly than White students, 1.60 more items correctly than Hispanic students, and 2.15 more items correctly than Black students. Similarly, White students answered 0.90 more items correctly than Hispanic students and 1.45 more items correctly than Black students. Hispanic students answered 0.55 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 1 for the 2018-2019 school year.

For STAAR Mathematics Reporting Category 1, a clear stair-step effect (Carpenter, Ramirez, & Severn, 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 1.

Table 1

Descriptive Statistics for the STAAR Mathematics Reporting Category 1 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	6.96	1.53
White	75,677	6.23	1.73
Hispanic	106,539	5.27	2.05
Black	23,486	4.64	2.15

2017-2018			
Asian	6,149	7.10	1.44
White	63,223	6.50	1.64
Hispanic	87,533	5.68	1.92
Black	19,425	4.99	2.07
2018-2019			
Asian	6,730	6.96	1.40
White	61,628	6.27	1.60
Hispanic	79,354	5.37	1.81
Black	18,103	4.81	1.93

Mathematics Reporting Category 2 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 212283) = 6195.78$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 176326) = 6714.64$, $p < .001$, partial $\eta^2 = .10$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 2 by ethnicity/race, $F(2, 165811) = 6801.15$, $p < .001$, partial $\eta^2 = .11$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 2, effect sizes were moderate for all three school years.

Following the three follow-up ANOVA procedures, Scheffe' post hoc procedures were conducted to determine which ethnic/racial pairings were statistically significantly different. Statistically significant differences on the STAAR Mathematics Reporting Category 2 were revealed for all of the ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 1.42 more items correctly than White students, 2.84 more items correctly than Hispanic students, and 4.00 more items correctly than Black students. Similarly, White students answered 1.42 more items correctly than Hispanic students and 2.59 more items correctly than Black students. Hispanic students answered 1.16 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 1.43 more items correctly than White students, 3.06 more items correctly than Hispanic students, and 4.05 more items correctly than Black students. Similarly, White students answered 1.64 more items correctly than Hispanic students and 2.63 more items correctly than Black students. Hispanic students answered 0.99 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 1.21 more items correctly than White students, 2.82 more items correctly than Hispanic students, and 3.88 more items correctly than Black students. Similarly, White students answered 1.61 more items correctly than Hispanic students and 2.67 more items correctly than Black students. Hispanic students answered 1.06 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 2 for the 2018-2019 school year.

For STAAR Mathematics Reporting Category 2, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 2.

Table 2

Descriptive Statistics for the STAAR Mathematics Reporting Category 2 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	11.55	2.36
White	75,677	10.13	2.90
Hispanic	106,539	8.71	3.39
Black	23,486	7.54	3.55
2017-2018			
Asian	6,149	11.36	2.25

White	63,223	9.93	2.76
Hispanic	87,533	8.30	3.19
Black	19,425	7.31	3.38
2018-2019			
Asian	6,730	11.51	2.17
White	61,628	10.30	2.66
Hispanic	79,354	8.69	3.07
Black	18,103	7.63	3.31

Mathematics Reporting Category 3 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 212283) = 5894.83$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 176326) = 5030.75$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 3 by ethnicity/race, $F(2, 165811) = 4897.95$, $p < .001$, partial $\eta^2 = .08$, moderate effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 3, effect sizes were moderate for all three school years.

Next, Scheffe' post hoc procedures revealed the presence of statistically significant differences on the STAAR Mathematics Reporting Category 3 for all ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.76 more items correctly than White students, 1.53 more items correctly than Hispanic students, and 2.05 more items correctly than Black students. Similarly, White students answered 0.76 more items correctly than Hispanic students and 1.29 more items correctly than Black students. Hispanic students answered 0.53 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.88 more items correctly than White students, 1.59 more items correctly than Hispanic students, and 2.13 more items correctly than Black students. Similarly, White students answered 0.71 more items correctly than Hispanic students and 1.25 more items correctly than Black students. Hispanic students

answered 0.54 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.63 more items correctly than White students, 1.31 more items correctly than Hispanic students, and 1.91 more items correctly than Black students. Similarly, White students answered 0.67 more items correctly than Hispanic students and 1.28 more items correctly than Black students. Hispanic students answered 0.60 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 3 for the 2018-2019 school year.

For the STAAR Mathematics Reporting Category 3, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Descriptive statistics for these analyses are contained in Table 3.

Table 3

Descriptive Statistics for the STAAR Mathematics Reporting Category 3 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	5.76	1.44
White	75,677	5.00	1.65
Hispanic	106,539	4.24	1.74
Black	23,486	3.71	1.79
2017-2018			
Asian	6,149	5.92	1.40
White	63,223	5.04	1.60
Hispanic	87,533	4.33	1.71
Black	19,425	3.79	1.76

2018-2019			
Asian	6,730	6.16	1.24
White	61,628	5.53	1.45
Hispanic	79,354	4.85	1.66
Black	18,103	4.25	1.76

Mathematics Reporting Category 4 Results Across All Three School Years

Concerning the 2016-2017 school year, a statistically significant difference was yielded on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 212283) = 4058.93$, $p < .001$, partial $\eta^2 = .05$, small effect size (Cohen, 1988). For the 2017-2018 school year, a statistically significant difference was present on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 176326) = 3211.55$, $p < .001$, partial $\eta^2 = .05$, small effect size (Cohen, 1988). With respect to the 2018-2019 school year, a statistically significant difference was again revealed on the STAAR Mathematics Reporting Category 4 by ethnicity/race, $F(2, 165811) = 2535.16$, $p < .001$, partial $\eta^2 = .04$, small effect size (Cohen, 1988). On the STAAR Mathematics Reporting Category 4, effect sizes were small for all three school years.

Scheffe' post hoc procedures were next conducted and revealed the presence of statistically significant differences on the STAAR Mathematics Reporting Category 4 for all ethnic/racial comparisons. With respect to the 2016-2017 school year, Asian students answered 0.44 more items correctly than White students, 0.80 more items correctly than Hispanic students, and 1.21 more items correctly than Black students. Similarly, White students answered 0.36 more items correctly than Hispanic students and 0.78 more items correctly than Black students. Hispanic students answered 0.42 more items correctly, on average, than Black students. Black students were the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2016-2017 school year.

For the 2017-2018 school year, Asian students answered 0.28 more items correctly than White students, 0.63 more items correctly than Hispanic students, and 1.00 more items correctly than Black students. Similarly, White students answered 0.35 more items correctly than Hispanic students and 0.72 more items correctly than Black students. Hispanic students answered 0.37 more items correctly than Black students. Again, Black students were the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2017-2018 school year.

Concerning the 2018-2019 school year, Asian students answered 0.33 more items correctly than White students, 0.58 more items correctly than Hispanic students, and 0.89

more items correctly than Black students. Similarly, White students answered 0.25 more items correctly than Hispanic students and 0.56 more items correctly than Black students. Hispanic students answered 0.31 more items correctly than Black students. Black students were again the lowest performing group on the STAAR Mathematics Reporting Category 4 for the 2018-2019 school year.

With respect to the STAAR Mathematics Reporting Category 4, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students outperformed White, Hispanic, and Black students; White students outperformed Hispanic and Black students; and Hispanic students outperformed Black students. Black students had the poorest mathematics scores in all three school years. Table 4 contains the descriptive statistics for these analyses.

Table 4

Descriptive Statistics for the STAAR Mathematics Reporting Category 4 by the Ethnicity/Race of Grade 3 Students

School Year and Ethnicity/Race	*n*	*M*	*SD*
2016-2017			
Asian	6,585	3.30	0.95
White	75,677	2.87	1.08
Hispanic	106,539	2.51	1.16
Black	23,486	2.09	1.21
2017-2018			
Asian	6,149	3.44	0.84
White	63,223	3.16	0.95
Hispanic	87,533	2.81	1.12
Black	19,425	2.44	1.20
2018-2019			
Asian	6,730	3.38	0.82
White	61,628	3.05	0.91
Hispanic	79,354	2.80	0.95

Black	18,103	2.49	1.01

Results for the STAAR Mathematics Approaches Grade Level Standard Across All Three School Years

Student performance on the STAAR Mathematics Approaches Grade Level standard was examined next through the use of Pearson chi-square procedures. This statistical procedure was the optimal statistical procedure to use because dichotomous data were present for the STAAR Mathematics Approaches Grade Level standard (i.e., met or did not meet this standard) and categorical data were present for ethnicity/race (i.e., Asian, White, Hispanic, Black). As such, the Pearson chi-square is the preferred statistical procedure when both variables are categorical (Field, 2009). Because a large sample size was present, the assumptions for using a chi-square were met.

With respect to the STAAR Mathematics Approaches Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 11683.95$, $p < .001$, small effect size, Cramer's V of .24 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Approaches Grade Level standard than White, Hispanic, and Black students. Asian students had 6.5% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 21.1% more than Hispanic students, and 34.9% more than Black students. White students had 14.6% more students who met this standard than Hispanic students and 28.6% more than Black students. Hispanic students had 14% more students who met this standard than Black students. Black students had the lowest percentages who met the Approaches Grade Level standard for the 2016-2017 school year. Table 5 contains the frequencies and percentages for this school year.

Table 5

Frequencies and Percentages for the STAAR Mathematics Approaches Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	6,280	95.40	305	4.60
White	67,260	88.90	8,417	11.10

Hispanic	79,193	74.30	27,346	25.70
Black	14,165	60.30	9,321	39.70
2017-2018				
Asian	5,959	96.90	190	3.10
White	57,892	91.60	5,331	8.40
Hispanic	68,490	78.20	19,043	21.80
Black	12,610	64.90	6,815	35.10
2018-2019				
Asian	6,526	97.00	204	3.00
White	56,853	92.30	4,775	7.70
Hispanic	62,648	78.90	16,706	21.10
Black	11,827	65.30	6,276	34.70

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 9605.03$, $p < .001$, small effect size, Cramer's V of .23 (Cohen, 1988). As delineated in Table 5, Asian students had 5.3% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 18.7% more than Hispanic students, and 32% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 26.7% more than Black students. Hispanic students had 13.3% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 9657.93$, $p < .001$, small effect size, Cramer's V of .24 (Cohen, 1988). As presented in Table 5, Asian students had 4.7% more students who met the STAAR Mathematics Approaches Grade Level standard than White students, 18.1% more than Hispanic students, and 31.7% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 27% more than Black students. Hispanic students had 13.6% more students who met this standard than Black students.

With respect to the STAAR Mathematics Approaches Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Approaches

Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Results for the STAAR Mathematics Meets Grade Level Standard Across All Three School Years

With respect to the STAAR Mathematics Meets Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 16728.56.95$, $p < .001$, small effect size, Cramer's V of .28 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Meets Grade Level standard than White, Hispanic, and Black students. Asian students had 22.2% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 44.4% more than Hispanic students, and 58.1% more than Black students. White students had 22.2% more students who met this standard than Hispanic students and 25.9% more than Black students. Hispanic students had 16.7% more students who met this standard than Black students. Black students had the lowest percentages who met the Meets Grade Level standard for the 2016-2017 school year. Table 6 contains the frequencies and percentages for this school year.

Table 6

Frequencies and Percentages for the STAAR Mathematics Meets Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	5,740	87.20	845	12.80
White	49,208	65.00	26,469	35.00
Hispanic	45,616	42.80	60,923	57.20
Black	6,845	29.10	16,641	70.90
2017-2018				
Asian	5,479	89.10	670	10.90
White	42,615	67.40	20,608	32.60

Hispanic	38,003	43.40	49,500	56.60
Black	5,798	29.80	13,627	70.20
2018-2019				
Asian	5,988	89.00	742	11.00
White	42,728	69.30	18,900	30.70
Hispanic	35,616	44.90	43,738	55.10
Black	5,514	30.50	12,589	69.50

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 15786.91$, $p < .001$, moderate effect size, Cramer's V of .30 (Cohen, 1988). As delineated in Table 6, Asian students had 21.7% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 44.7% more than Hispanic students, and 59.3% more than Black students. White students had 23% more students who met this standard than Hispanic students and 36.6% more than Black students. Hispanic students had 14.6% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 15848.13$, $p < .001$, moderate effect size, Cramer's V of .31 (Cohen, 1988). As presented in Table 6, Asian students had 4.7% more students who met the STAAR Mathematics Meets Grade Level standard than White students, 18.1% more than Hispanic students, and 31.7% more than Black students. White students had 13.4% more students who met this standard than Hispanic students and 27% more than Black students. Hispanic students had 13.6% more students who met this standard than Black students.

With respect to the STAAR Mathematics Meets Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Meets Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Results for the STAAR Mathematics Masters Grade Level Standard Across All Three School Years

With respect to the STAAR Mathematics Masters Grade Level standard by the ethnicity/race of Grade 3 students, the result for the 2016-2017 school year was statistically significant, $\chi^2(2) = 15205.24$, $p < .001$, small effect size, Cramer's V of .27 (Cohen, 1988). Statistically significantly higher percentages of Asian students met the STAAR Mathematics Masters Grade Level standard than White, Hispanic, and Black students. Asian students had 30.5% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 48.1% more than Hispanic students, and 56.4% more than Black students. White students had 17.6% more students who met this standard than Hispanic students and 25.9% more than Black students. Hispanic students had 8.3% more students who met this standard than Black students. Black students had the lowest percentages who met the Masters Grade Level standard for the 2016-2017 school year. Table 7 contains the frequencies and percentages for this school year.

Table 7

Frequencies and Percentages for the STAAR Mathematics Masters Grade Level Standard by the Ethnicity/Race of Grade 3 Students

	Met Standard		Did Not Meet Standard	
School Year and Ethnicity/Race	*n*	%	*n*	%
2016-2017				
Asian	4,538	68.90	2,047	31.10
White	29,088	38.40	46,589	61.60
Hispanic	22,171	20.80	84,368	79.20
Black	2,925	12.50	20,561	87.50
2017-2018				
Asian	4,269	69.49	1,880	30.60
White	24,395	38.60	38,828	61.40
Hispanic	16,733	19.10	70,800	80.90
Black	2,159	11.10	17,266	88.90
2018-2019				

Asian	4,688	69.70	2,042	30.30
White	25,540	41.40	36,088	58.60
Hispanic	16,128	20.30	63,226	79.70
Black	2,176	12.00	15,927	88.00

Concerning the 2017-2018 school year, a statistically significant difference was revealed, $\chi^2(2) = 15178.82$, $p < .001$, small effect size, Cramer's V of .29 (Cohen, 1988). As delineated in Table 7, Asian students had 30.8% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 50.3% more than Hispanic students, and 58.3% more than Black students. White students had 19.5% more students who met this standard than Hispanic students and 27.5% more than Black students. Hispanic students had 8% more students who met this standard than Black students.

Regarding the 2018-2019 school year, the result was statistically significant, $\chi^2(2) = 15383.09$, $p < .001$, moderate effect size, Cramer's V of .30 (Cohen, 1988). As presented in Table 7, Asian students had 28.3% more students who met the STAAR Mathematics Masters Grade Level standard than White students, 49.4% more than Hispanic students, and 57.7% more than Black students. White students had 21.1% more students who met this standard than Hispanic students and 29.4% more than Black students. Hispanic students had 8.3% more students who met this standard than Black students.

With respect to the STAAR Mathematics Masters Grade Level Standard, a clear stair-step effect (Carpenter et al., 2006) was present for all three school years. In all three school years, Asian students were the highest performing group to meet the Masters Grade Level standard, followed by White, Hispanic, and Black students. White students had the second highest percentage of students who met this performance standard, followed by Hispanic students. In all three school years, Black students had the lowest percentage of students who met this mathematics performance standard.

Trends in Mathematics Performance by Student Ethnicity/Race

In analyzing the mathematics achievement of Grade 3 students in Texas across the three years of data that were examined, trends in scores were present by ethnicity/race. In each STAAR Mathematics Reporting Category and in all three years investigated, a clear stair-step effect was observed (Carpenter et al., 2006). In all instances Asian students had the highest mathematics achievement, followed by White students, then Hispanic students and finally Black students. Concerning the STAAR Mathematics Performance Level standards, the same stair-step effect was present. Statistically significantly higher percentages of Asian

students met each of the three STAAR Mathematics Performance Level Standards, followed by White students, then Hispanic students, and finally by Black students. These trends are revealed in Figures 1 through 7.

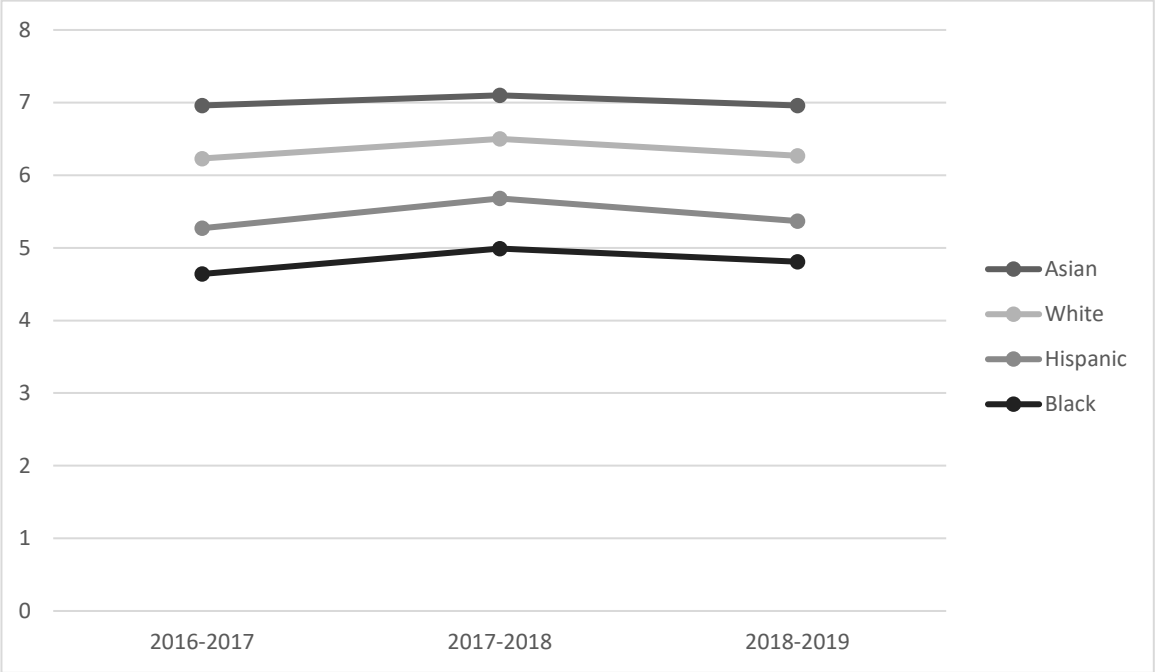

Figure 1. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 1 for the 2016-2017, 2017-2018, and 2018-2019 school years*

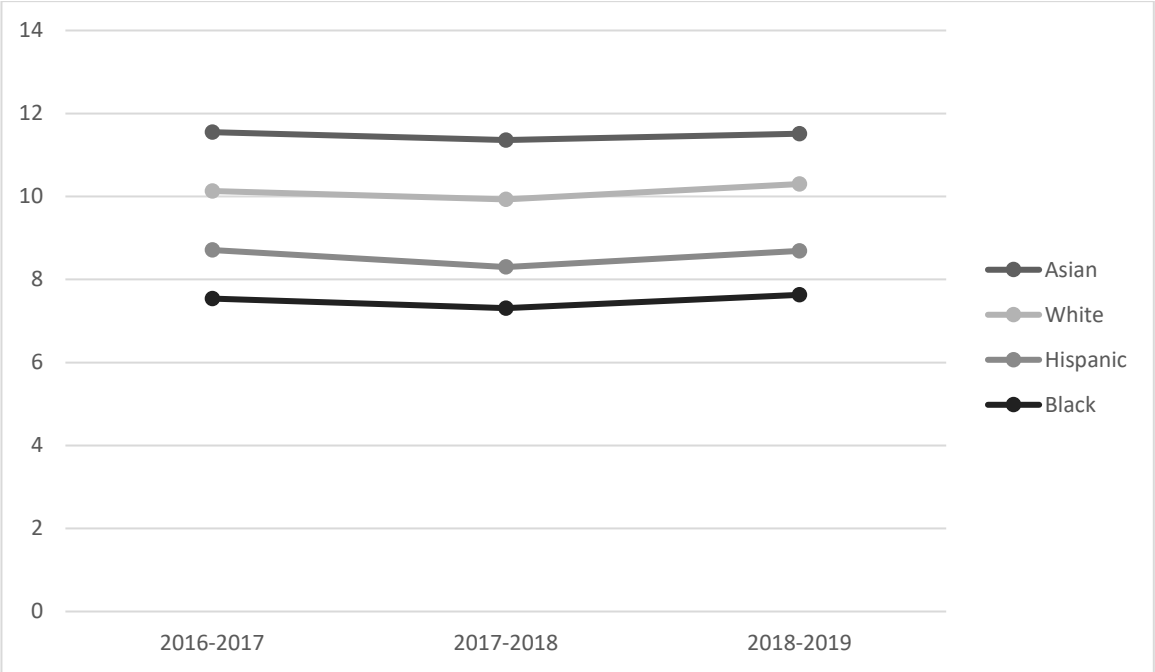

Figure 2. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 2 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

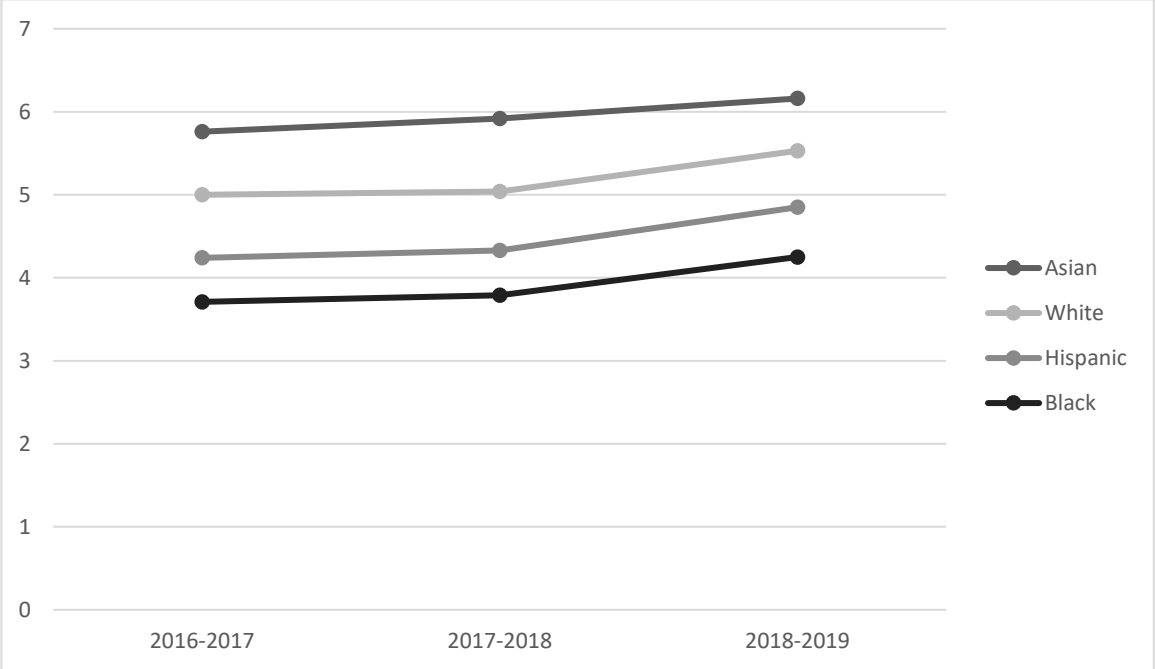

Figure 3. *Average scores by ethnicity/race of Grade 3 students in Texas for the STAAR Grade 3 Mathematics Reporting Category 3 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

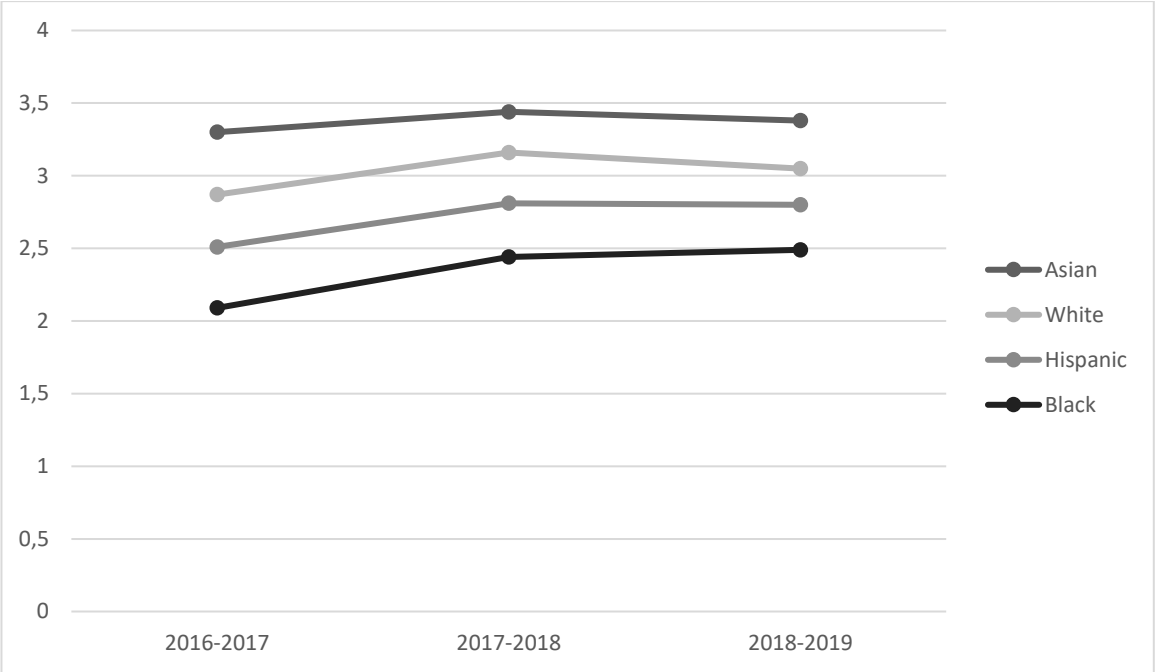

Figure 4. *Average scores by ethnicity/race of Grade 3 Students in Texas for the STAAR Grade 3 Mathematics Reporting Category 4 for the 2016-2017, 2017-2018, and 2018-2019 school years.*

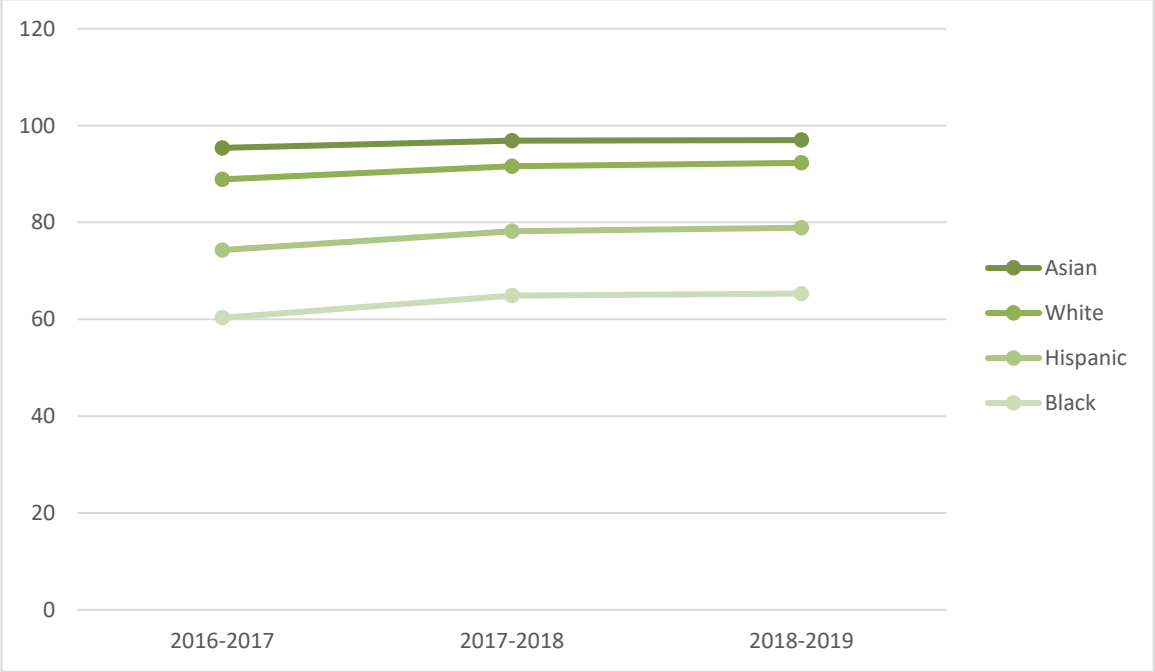

Figure 5. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Approaches Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

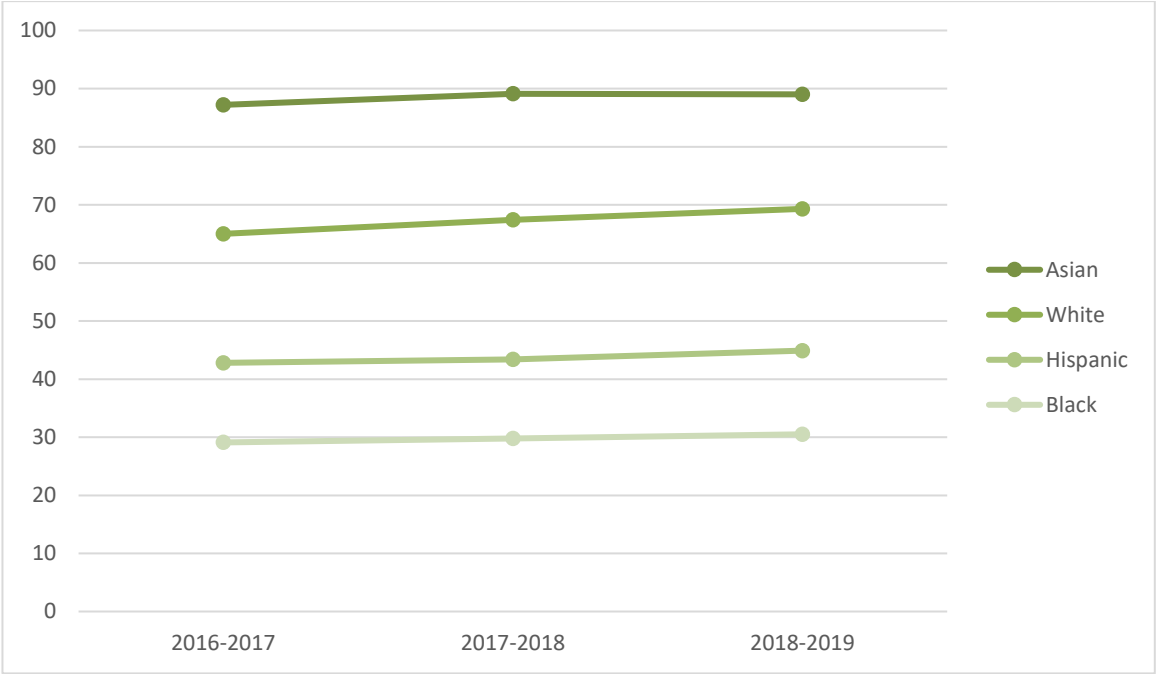

Figure 6. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Meets Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

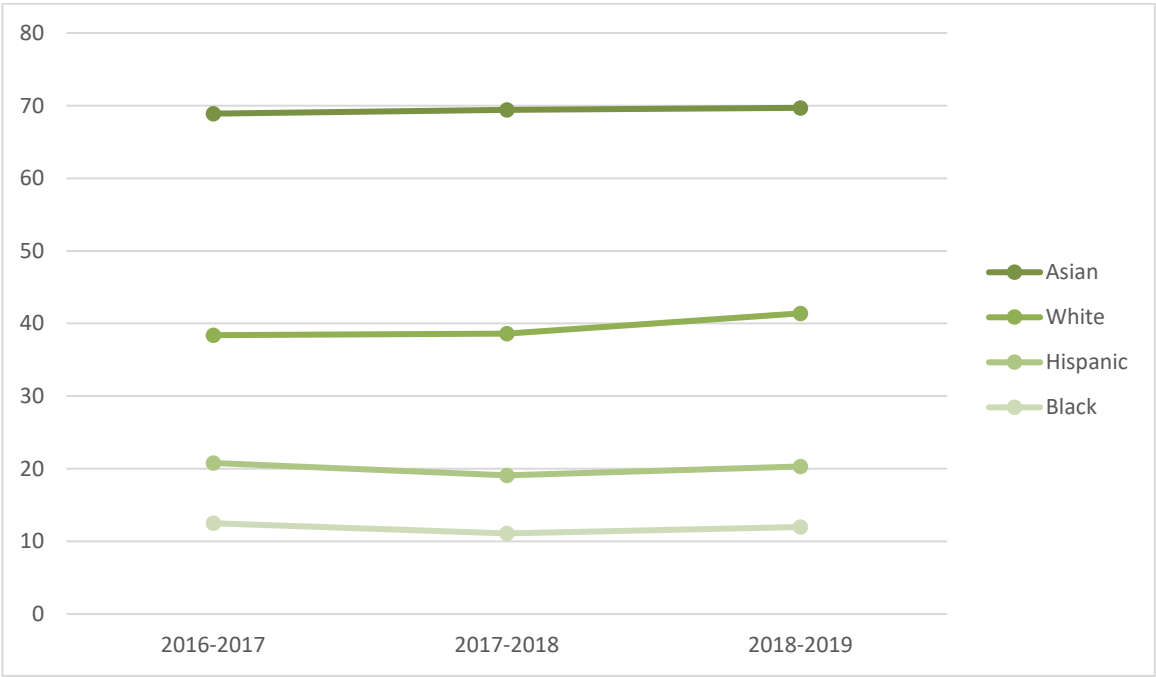

Figure 7. *Average percentages by ethnicity/race for the STAAR Grade 3 Mathematics Masters Grade Level Standard for the 2016-2017, 2017-2018, and 2018-2019 school years.*

DISCUSSION

The mathematics achievement of Grade 3 students by their ethnicity/race was investigated in this statewide, multiyear study. Mathematics achievement was determined using two different sets of measures: (a) number of test items answered correctly in each STAAR Mathematic Reporting Category and (b) percentages of students who met the three performance level standards. Statistically significant results were present in all of the mathematics achievement measures in all three school years examined.

Connections to Existing Literature

As revealed in this study, ethnic/racial differences were present in the mathematics achievement of Grade 3 students. These findings were congruent with the results of other researchers (Alford-Stephens, 2016; Harris, 2018; McGown, 2016) who established the presence of ethnic/racial achievement gaps being present for students in Texas. Their investigations, as well as the findings discussed in this article, provide evidence for a clear stair-step effect (Carpenter et al., 2006) in student mathematics achievement. Asian students consistently outperformed White students, Hispanic students, and Black students. In addition, results are commensurate with national research of substantial ethnic/racial academic gaps (e.g., Braun, Chapman, & Vezzu, 2010; Growe & Montgomery, 2003; Reardon, Cimpian, & Weathers, 2015; Reardon & Galindo, 2009; Reardon, Kalogrides, & Shores, 2019; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009). The Nation's Report Card (2019) revealed a similar clear stair-step effect (Carpenter et al., 2006) as this study with Asian students having the best performance, followed by White students, Hispanic students, and Black students.

Implications for Policy and for Practice

Based upon the results discussed herein, several implications for policy and practice can be recommended. Black and Hispanic students continue to be outperformed by Asian and White students in mathematics achievement. First, with respect to policy, funds should be provided to districts and schools who have a high population of Black and Hispanic students to assist with mathematics interventions and resources. Second, teacher preparation programs must ensure prospective teachers are learning about the challenges faced by students from different ethnic/racial backgrounds. Prospective teachers should be taught strategies that will allow them to meet the academic, social, and emotional needs of their students. Last, annual professional development should be mandated to provide teachers with the latest research evidence regarding how students from different ethnic/racial backgrounds are progressing in mathematics. Trainings should be required yearly so teachers can learn about new strategies and resources to assist them in their classrooms.

Concerning practice, district and campus leaders must monitor student performance in mathematics before Grade 3 when state testing begins for students. Second, with the monitoring of student achievement in earlier grades, earlier interventions should be put in place for students struggling to master mathematical concepts and skills. Progress monitoring should be implemented by districts and schools to ensure all interventions are effective for students, especially students from historically low performing groups. Finally, school leaders should utilize assessment scores from the Grade 3 STAAR Mathematics exam to choose proper interventions and remediations for students to ensure growth for the next school year.

LIMITATIONS AND RECOMMENDATIONS

Several recommendations for future research can be offered based on the results of this statewide, multiyear investigation. First, researchers should determine if similar gaps are present in the mathematics achievement of students in other grade levels as a function of student ethnicity/race. Second, researchers should examine how economic status may affect the mathematics achievement of Black and Hispanic boys. A similar study should also be conducted for Black and Hispanic girls. Third, researchers should conduct this study in other states to determine the extent to which findings presented herein would be generalizable to other states. In this particular study, the focus was only on ethnic/racial differences. Therefore, researchers should analyze if mathematical differences are present based upon other student demographics. Last, researchers should include qualitative and mixed studies to obtain a better understanding regarding the relationship between ethnicity/race and mathematics achievement.

CONCLUSION

The purpose of this research study was to determine the extent to which differences were present in the mathematics achievement of Texas Grade 3 students as a function of their ethnicity/race. Analysis of three school years of Texas statewide data yielded statistically significant differences in the mathematics achievement by ethnicity/race. In all three school years, a stair-step effect (Carpenter et al., 2006) was clearly present. Asian students consistently outperformed White, Hispanic, and Black students in all four STAAR Mathematic Reporting Categories as well as all three STAAR Mathematics Performance Level standards. White students outperformed Hispanic and Black students. Black students were consistently the lowest performing ethnic/racial group. Findings were consistent with prior researchers (e.g., Alford-Stephen, 2016; Braun et al., 2010; Growe & Montgomery, 2003; Harris, 2018; McGown, 2016; Reardon et al., 2015; Reardon & Galindo, 2009; Reardon & Portillo, 2016; Rowley & Wright, 2011; Shirvani, 2009).

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Biographical notes:

Dr. Gaylon Davenport: **Dr. Gaylon Davenport is a recent graduate of the doctoral program in Educational Leadership at Sam Houston State University. He is currently a school superintendent in East Texas.**

Dr. John R. Slate: **Dr. John R. Slate is a Full Professor in the Department of Educational Leadership at Sam Houston State University.**

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Research

The mediating role of general self-efficacy in the relationship between metacognition and academic success of university students

Deniz Koyuncuoğlu[1]

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Abstract:

The objective of this study was to investigate the relationships between metacognition, general self-efficacy, and academic success among university students, and to examine the mediating role of general self-efficacy in these relationships. The study used a correlational research design and 360 university students participated by completing the Demographic Information Form, General Self-Efficacy Scale, and Metacognition Scale-30. Pearson correlation coefficients were used to analyze the relationships between variables, while structural equation modeling was employed to test the mediating role of general self-efficacy. The findings showed that there were positive associations between academic success and both metacognition and general self-efficacy. Furthermore, general self-efficacy was found to partially mediate the relationship between metacognition and academic success. The results suggested that supporting students' general self-efficacy beliefs could lead to increased metacognitive awareness and improved academic success. The implications of these findings were discussed in terms of higher education policies. The study's potential limitations include biases or social desirability effects that could result from using self-reported measures. Furthermore, the sample of university students may not be representative of the larger population, and the study's findings are limited to a particular geographic or cultural context. In summary, the study highlights the importance of metacognition and general self-efficacy for academic success among university students and underscores the need for interventions that aim to enhance these factors.

Keywords: Metacognition, General self-efficacy, Academic success, University students, Higher education policy implications

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[1] Dr., Kırklareli University, School of Health Services Vocational Higher Education, Kırklareli, Türkiye. deniz.bas@klu.edu.tr, Orcid ID: 0000-0002-4068-8386

INTRODUCTION

The primary goal of education and training in higher education is for students to attain the necessary qualifications and achieve academic success. Academic success is defined by students meeting the program's content and learning outcomes. Numerous individual and environmental factors impact academic success, including cognitive, affective, and physical factors originating from the student (Kurt & Erdem, 2012; Sarıer, 2016). Scholarly literature highlights the significance of metacognition and self-efficacy in academic success. Studies have associated academic achievement with individual factors, such as metacognition (Adıgüzel & Orhan, 2017; Bağçeci et al., 2011; Sawhney & Bansal, 2015; Stephanou & Tsoni, 2019) and self-efficacy (Ardura & Galan, 2019; Koca & Dadandı, 2019; Nasir. & Iqbal, 2019; Tataroğlu, 2009).

Metacognition, which is defined as "thinking about thinking" in its simplest form, has an important role in students' learning. If cognition refers to the learning skills that students apply to fulfill a task, metacognition can be defined as being aware of and reflecting one's own cognitive processes (Flavell, 1976). With his studies in the following years, Flavell (1979) further developed this definition and explained metacognition as a) information about the cognition of individuals, b) information about cognitive tasks, c) information about the strategies applied in the fulfillment of different tasks, and d) the ability to monitor the cognitive activities of the individual. In this direction, metacognition is the management and regulation of these processes, including awareness of cognitive processes and the selection and implementation of appropriate strategies related to the subject to be learned.

Downing et al. (2009) defined metacognition as the ability to analyze and reflect on one's own thinking, draw conclusions based on this analysis, and apply what has been learned to practical situations. In order to effectively address challenges, it is important for students to have an understanding of their own cognitive processes. In other words, students must be aware of how they carry out important cognitive activities like remembering, learning, and problem solving.

Metacognition is an individual's level of consciousness or understanding of the information that they have acquired. This comprehension can be conveyed through applying the knowledge in practice or by articulating it verbally. In essence, it involves recognizing one's thought processes and identifying potential solutions when addressing issues, making choices, or interpreting text. It also requires making well-informed decisions and continuously evaluating one's progress. Metacognition is characterized by a proactive, deliberate, and systematic approach and the ability to critically evaluate one's own learning (Sawhney & Bansal, 2015).

Studies emphasize three basic concepts related to metacognition, these are cognitive knowledge, metacognitive experiences and metacognitive regulation (Flavell, 1979;

Efklides, 2008). Cognitive knowledge is the individual's knowledge of his or her own cognition or general cognition. Beliefs about cognitive processes and the factors affecting their outcomes are cognitive knowledge and this knowledge is used to control thinking processes (Anderson, 2012). Metacognitive experiences are the elements of metacognitive knowledge that has entered consciousness. These are the conscious mental and affective experiences of the individual regarding the self, the subject to be learned, goals and strategies (Blummer & Kenton, 2014). Metacognitive experiences may occur before, in the middle or after a cognitive attempt, may be short or long in duration, or simple or complex in content (Flavell, 1979). Metacognitive regulation, on the other hand, is defined as the arrangements made by individuals to monitor and control their cognitive processes. A wide variety of processes, such as understanding task requirements, identifying personal strengths and weaknesses, identifying failures or changing strategies, all require metacognitive regulation skills (Roebers & Spiess, 2017).

Individuals with high metacognitive awareness plan which subjects they already know and which they should know, where and how they can find information about these subjects and learn about them. Then he reviews the plans he has created, makes the necessary changes, and iterates. As individuals become more aware of metacognition, their skills related to thought processes are expected to increase, and they are expected to use these skills both in the learning process and in other areas of their lives (Coutinho, 2007; Dunning et al., 2003).

Metacognition is a strong predictor of academic performance and is therefore directly related to academic success. Therefore, students with good metacognition have high academic averages (Coutinho, 2007). Gama (2005) studied students who have difficulty in successfully completing the learning process and it was found that these students had problems in determining the difficulty level of the task, planning the learning before starting, determining the degree of success and the subject matter, the Apply previous knowledge and make quick decisions. These are problems related to metacognitive skills. Therefore, the inadequacy of individuals in their metacognitive abilities negatively affects their academic achievment.

A common research theme is the investigation of the relationship between metacognition and academic achievement. Mirzaei et al. (2012) studied 195 undergraduate physics students to examine the link between students' beliefs, metacognitions, academic goals, and academic achievement. Data was collected using a 7-point Likert scale, and the results showed that metacognition is a significant predictor of academic success. In another study, Romainville (1994) investigated the connection between the metacognitive characteristics of 35 economics students and their academic achievement. Through structured interviews, the data analysis indicated that high-achieving students were more aware of cognitive rules and frequently used metacognitive knowledge about cognitive processes and outcomes. On the other hand, in Eriyani's (2020) study with prospective teachers, there was a weak relationship found between metacognitive awareness and

academic achievement. Therefore, interventions that increase students' metacognitive awareness throughout their educational journey can help address future challenges and facilitate their learning process.

Another concept that is closely related to academic success is self-efficacy, because having low self-efficacy beliefs hinders academic achievement and can lead to self-fulfilling prophecies about lack of success and learned helplessness, which can ultimately negatively affect one's psychological well-being (Margolis & McCabe, 2006).

The concept of self-efficacy emerged based on Social Cognitive Theory and was defined by Bandura (1997) as the belief in one's ability to organize and execute the necessary action plans to manage possible situations. In other words, self-efficacy describes individuals' personal evaluations of what they can achieve with their abilities and skills and what level of success they can achieve (Maddux & Gosselin, 2003).

Bandura (1989) explained the sources of the emergence and development of self-efficacy as past experience, indirect experience, imagination, verbal persuasion, and psychological and emotional conditions. Past experiences, including success and failure, cause individuals to strengthen or weaken their beliefs about effectiveness. Students may feel unsuccessful because of past experiences, and small changes should be made in schools to replace such memories with new ones.

The effectiveness of indirect experiences increases depending on the quantity and quality of learning experiences that the individual can observe and model. In other words, observing an individual's behavior while someone else is doing it increases his/her belief that he/she will be successful in performing that behavior. For this reason, Bandura (1994) emphasizes that peers have a great influence on students' behavior in educational settings.

Imagination capacity enables individuals to understand and intuit situations, events and emotional reactions that can affect their sense of efficacy. Verbal persuasion states that individuals can be encouraged or discouraged based on what they are told. For this reason, individuals who are verbally persuaded that they will be successful will overcome them successfully when they encounter social or individual difficulties. For this reason, communication is of great importance at school and at home, and verbal reinforcers should be used carefully.

Psychological conditions also affect efficacy because a timid attitude towards a behavior can lead to failure and raise doubts about the individual's own abilities. Emotional conditions such as high levels of anxiety and depression can also negatively affect efficacy beliefs. A positive mood supports the self-efficacy of individuals, while a depressed mood decreases self-efficacy.

As a result, it is not the emotional and physical reactions that shape individuals' self-efficacy beliefs, but how these reactions are perceived and interpreted by individuals. While people with positive self-efficacy beliefs do not associate some affective factors with their

own abilities, individuals with low self-efficacy beliefs interpret them as the main reason for their failure (Bandura, 1994).

Self-efficacy affects individuals' willingness to learn any subject. While students avoid performing tasks that they believe will not be successful, they are willing to undertake very difficult tasks in areas where they have high self-efficacy beliefs. For this reason, self-efficacy is an important factor that can affect the academic success of individuals in a particular learning area (Nasir & İkbal, 2019).

Motlagh et al. (2011) conducted their studies examining the relationship between self-efficacy and scholastic success with 250 high school students. After analyzing the self-efficacy scale and performance scores, they concluded that self-efficacy is an important factor in academic performance. In a longitudinal study by Hwang et al. (2016), in which 1177 students in the eighth to twelfth grades were examined, it was found that there is a mutual connection between academic performance and self-efficacy. Accordingly, it was observed that students with high academic achievements in one semester showed a high self-efficacy perception in the following semester and students with high self-efficacy perceptions showed an increase in their academic success in the following semester. In a similar longitudinal study conducted with 412 Italian students, Caprara et al. (2011) concluded that there is a reciprocal relationship between students' self-efficacy and academic performance.

As at all educational levels, metacognition and self-efficacy have a significant impact on academic achievement at the university level. A university student with limited metacognitive skills will have difficulty in understanding the requirements of the subject to be learned, will have difficulty in distinguishing important information about the subject and will not be able to manage his own learning process. Low self-efficacy perception will negatively affect his self-confidence in the learning process and prevent him from revealing his potential (Kaplan, 2019).

Although there are many studies (Al-Baddareen et al., 2015; Aurah, 2013; Goli et al., 2016; Hassan et al., 2022; Hermita et al., 2015; Hrbackova et al., 2012; Honicke & Broadbent, 2016; Koca & Dadandı, 2019; Komarraju & Nadler, 2013; Rampp & Guffey, 1999; Stephanou & Tsoni, 2019) examining the relationship between metacognition, self-efficacy, and academic achievement , there are hardly any studies examining the mediating role of self-efficacy in the effect of success. In this direction, the aim of this study is to examine the predictive relationships between metacognition, academic success, and general self-efficacy in students and to determine the mediating role of general self-efficacy in this context. The following hypotheses were developed for this purpose:

H1: Metacognition has a positive effect on academic success.

H2: Metacognition has a positive effect on self-efficacy.

H3: Self-efficacy has a positive effect on academic success.

H4: Self-efficacy mediates the relationship between metacognition and academic success.

METHOD

This study was based on the correlational research design. Correlational studies aim to determine the extent to which some type or types of relationship exist. With this type of research, the researcher aims to conduct research in order to find and define the relationships that may exist between naturally occurring phenomena, without trying to change these phenomena in any way (Büyüköztürk et al., 2012). In this study, the relationships between metacognition, general self-efficacy and academic achievement were discussed using a correlational research design. The ethics committee permission document required to collect the data used in this study were obtained with decision number 2021/363 of the Ethics Committee of Necmettin Erbakan University dated 18.06.2021.

Research Group

The study group of this research consists of 360 university students studying at Konya Necmettin Erbakan University. Participation in the research was based on volunteerism and the students were informed about the study. Easily accessible sampling method was preferred in the selection of students. 55% (n=198) of the students were female and 45% (n=162) were male. 25% (n=90) of the students are first-year, 40% (n=144) are second-year students, 20% (n=72) are third-year students, and 15% (n=54) are fourth-year students. 69.4% (n=250) of the students are faculty students and 30.6% (n=110) are college students. The ages of the students ranged from 18 to 27 and the average age was calculated as 20.75 (Sd=1.91).

Data Collection Tools

Demographic Information Form: A demographic information form developed by the researcher was used to obtain the descriptive information of university students. The form included variables of gender, grade level, academic grade point average, school type and age. The form includes open-ended and multiple-choice questions.

General Self-Efficacy Scale-GSE: Schwarzer and Jerusalem (1995) created this scale, which was then validated and tested for reliability in its Turkish form by Aypay (2010). The scale contains 10 items that are divided into two dimensions, which are effort and resistance, ability and self-confidence. The scale relies on self-reported responses, where each item is rated from exactly true (4) to not at all true (1). High scores on the scale indicate strong general self-efficacy beliefs. The study found that the alpha coefficients for the effort and resistance, ability and self-confidence dimensions of the scale were 0.87 and 0.83.

Metacognition Scale-30: Wells and Cartwright-Hatton (2004) created a measurement tool, which was later adapted for Turkish use by Tosun and Irak (2008). The scale consists of 30 items and is composed of five distinct dimensions, namely positive beliefs, cognitive

confidence, uncontrollability and danger, cognitive awareness, and the need to control thoughts. The scale is based on self-report and each item is scored as strongly agree (4), agree (3), disagree (2), and strongly disagree (1). High scores obtained from the scale indicate a high level of metacognitive awareness. In this study, the alpha coefficients of the scale calculated for the dimensions of positive beliefs, cognitive confidence, uncontrollability and danger, cognitive awareness and control of thoughts were 0.86, 0.77, 0.87, 0.81, and 0.92.

Academic Success: Grade point averages were taken into account in measuring the academic success of the students. According to the 4-point assessment system used to evaluate the grades given to each student, grade point averages of 3.00 and above were classified as "high", grade point averages between 2.00 and 2.99 were classified as "medium", and grade averages of 2.00 and below were classified as "low" academic success.

Analysis of Data

Some assumptions were checked before the data were analysed. In the first step, the distribution of the scores obtained from the scales was examined by calculating the skewness and kurtosis coefficients. The skewness and kurtosis coefficients in the range of ±1 indicate that the assumption of normal distribution is met (Hair et al., 2013). The calculated coefficients were within the specified range, and the assumption of normal distribution was met (Table 1).

Table 1. Skewness and Kurtosis Coefficients

Variables	Skewness		Kurtosis	
	z	SH	z	SH
Academic success	0,00	0,13	-0,35	0,26
Effort and resistance	-0,01	0,13	-0,90	0,26
Ability and self-confidence	-0,38	0,13	-0,02	0,26
Positive beliefs	0,39	0,13	-0,65	0,26
Cognitive confidence	0,79	0,13	-0,18	0,26
Uncontrollability and danger	0,20	0,13	-0,76	0,26
Cognitive awareness	-0,55	0,13	-0,45	0,26
Need to control thoughts	0,05	0,13	-0,41	0,26

The mediating role of general self-efficacy between metacognition and academic achievement was tested by applying structural equation model analysis. Cook distance values calculated before the analysis indicated that there were no extreme values in the data set (Cook distance <1). Multicollinearity was examined by calculating the variance increase factor (VIF) values (Çokluk et al., 2010). The obtained values showed that there was no multicollinearity between the variables (1.47≤VIF≤2.86). Preliminary analysis results

indicated that the data were suitable for multivariate analysis. Analyzes were carried out with the AMOS 24.0 statistical package program.

Ethical consideration

In this study, all the rules specified under the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were adhered to. None of the actions listed under the section "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were taken.

Ethical review board name: Necmettin Erbakan University Social and Humanities Scientific Research Ethics Committee

Date of ethics review decision: 18.06.2021

Ethics assessment document issue number: 2021/363

RESULTS

The results of the correlation and mediator variable analysis are presented in this section.

Correlation Analysis Results

Table 1. Pearson Correlation Coefficients of the Relationships Between Academic Success, Self-Efficacy and Metacognition Components

	Variables	Mean	Sd	1.	2.	3.	4.	5.	6.	7.	8.
1.	Academic success	2,02	0,61	1							
2.	Effort and resistance	17,84	3,91	0,43**	1						
3.	Ability and self-confidence	12,88	2,17	0,43**	0,76**	1					
4.	Positive beliefs	2,11	0,75	0,31**	0,27**	0,31**	1				
5.	Cognitive confidence	1,95	0,80	0,26**	0,17**	0,15**	0,42**	1			
6.	Uncontrollability and danger	2,45	0,79	0,41**	0,25**	0,26**	0,41**	0,51**	1		
7.	Cognitive awareness	2,78	0,77	0,37**	0,31**	0,30**	0,36**	00,09	0,50**	1	
8.	Need to control thoughts	2,36	0,67	0,43**	0,33**	0,32**	0,52**	0,42**	0,65**	0,68**	1

**p<0,01; N=360

Upon examining the table, it becomes evident that academic success shares low to moderate positive correlations with several factors. These include effort and resilience (r=0.43; p<0.01), ability and confidence (r=0.43; p<0.01), positive beliefs (r=0.31; p<0.01), cognitive confidence (r=0.26; p<0.01), the perception of uncontrollability and danger (r=0.41; p<0.01), cognitive awareness (r=0.37; p<0.01), and the need to control thoughts (r=0.43; p<0.01). In addition, it can be seen that academic success also increases with increasing components of self-efficacy and metacognition.

Effort and resistance and positive beliefs (r=0.27; p<0.01), cognitive confidence (r=0.17; p<0.01), uncontrollability and danger (r=0.25; p<0.01), cognitive awareness (r=0.31; p<0.01), and the need to control thoughts (r=0.33; p<0.01), there are low and moderate positive correlations. As the effort and resistance scores increased, the metacognition components also increased.

Ability and self-confidence and positive beliefs (r=0.31; p<0.01), cognitive confidence (r=0.15; p<0.01), uncontrollability and danger (r=0.26; p<0,01), cognitive awareness (r=0.30; p<0.01), and the need to control thoughts (r=0.32; p<0.01), there are low and moderate positive correlations. As ability and confidence scores increased, metacognition components also increased.

Mediator Variable Analysis Results

To test the research hypotheses, the study used the structural model presented in Figure 1. Metacognition was considered as the independent variable, academic achievement as the dependent variable, and general self-efficacy as the mediator variable. The fit values calculated ($\chi 2$/sd=1.33, RMSEA=0.03, SRMR=0.03, CFI=1.00, GFI=0.99, AGFI=0.97, TLI=0.99 and IFI=1.00) indicated that the model and data were perfectly aligned (Browne & Cudeck, 1993; Carmines & McIver, 1981; Jöreskog & Sörbom, 1984; McDonald & Marsh, 1990; Tanaka & Huba, 1985). Table 2 shows the path coefficients and significance levels in the model.

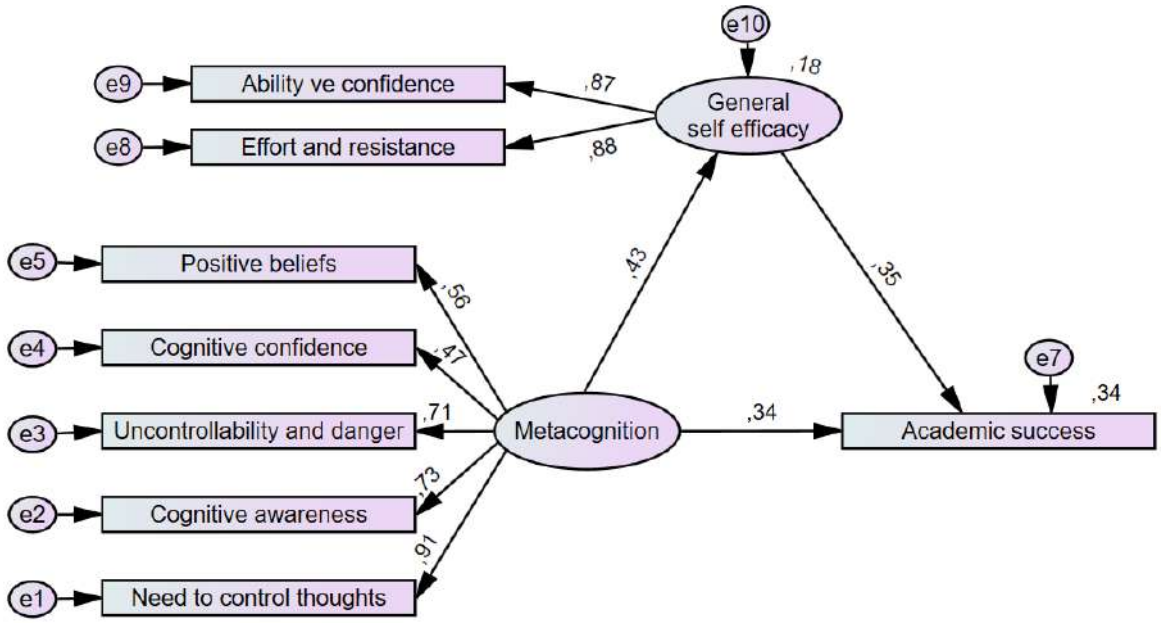

Figure 1. Structural Model, χ^2=19,10; Sd=15; p=0,17

Table 2. Total, Direct and Indirect Effects

			β	Sh	p	%95 CI		Hypothesis
						Min	Max	
	Total effect							
Metacognition	--->	Academic success	0,49	0,05	0.00**	0,37	0,60	accepted
	Direct effect							
Metacognition	--->	Academic success	0,34	0,09	0.00**	0,31	0,56	accepted
Metacognition	--->	Self-efficacy	0,43	0,09	0.00**	0,21	0,47	accepted
Self-efficacy	--->	Academic success	0,35	0,01	0.00**	0,24	0,46	accepted
	Indirect effect							
Metacognition	--->	Academic success	0,15	0,04	0.00**	0,09	0,23	accepted

**p<0,01

The results indicate that metacognition has a positive overall effect on academic success, with a β coefficient of 0.49, and the hypothesis is accepted. The direct effect of metacognition on academic success is also significant (β = 0.34), which means that part of the positive overall effect is directly attributable to metacognition.

There is also a significant positive effect of metacognition on self-efficacy (β = 0.43), indicating that higher levels of metacognition are associated with higher levels of self-efficacy. Self-efficacy also has a significant direct influence on academic success (β = 0.35), meaning that those who believe in their ability to succeed are actually more successful.

The indirect effect of metacognition on academic success through self-efficacy is also significant (β = 0.15), meaning that part of the positive overall effect of metacognition on academic success is mediated by the positive influence of metacognition on self-efficacy. According to the results obtained, the H1, H2, H3 and H4 hypotheses were accepted.

DISCUSSION

The aim of this study was to explore the interrelationships between metacognition, academic success, and general self-efficacy in university students. The results indicated a positive association between metacognition and general self-efficacy as well as academic success. These findings are consistent with previous research, such as the studies conducted by Cera et al. (2013), Hwang et al. (2016), Polat and Uslu (2012), Raoofi et al. (2014), and Vrugt and Oort (2008). For instance, Young and Fry (2008) conducted a study with university students and found a significant correlation between metacognitive awareness and academic success. Similarly, Cheng and Chiou (2010) identified a positive and significant correlation between general self-efficacy and academic success.

Metacognition is the awareness of what one knows and the ability to understand it. This interpretation arises from the use or explanation of knowledge when thinking, problem solving, making decisions, or interpreting an event. Individuals are aware of what they know, make conscious choices, and take an active and systematic approach to the learning process (Sawhney & Bansal, 2015). Ackerman and Goldsmith (2011) state that information on their own learning processes affects the academic success of students. As metacognitive awareness increases, so will academic success (Thomas & McRobbie, 2001), since students will be able to recognize their deficiencies and weaknesses, and make realistic and accurate decisions on how to learn a subject with the help of their metacognitive awareness.

According to Demirci (2021), instructing individuals on metacognitive strategies such as planning, implementing, and evaluating can enhance their autonomy in the learning process and lead to improved academic outcomes. The study indicates a positive correlation between metacognition and academic success in university students, implying that the participants are taking ownership of their learning and being conscious of the learning process. This is particularly relevant for undergraduate students who have to make decisions on what, when, and how to learn during their academic journey.

The study found that higher levels of general self-efficacy were positively associated with greater academic success. General self-efficacy refers to an individual's belief in their ability to influence events that affect their lives (Bandura, 1997). Those who have confidence in their abilities and believe that they can accomplish their goals will approach learning with a more positive and determined attitude, leading to enhanced academic success. The research suggests that the high levels of general self-efficacy observed among the students in the study had a positive impact on their academic performance. These findings are consistent with those of previous studies, including Ardura and Galan's (2019) research with 507 students, which found that self-efficacy was a predictor of academic success. Similarly, Hwang et al. (2016) observed a significant association between self-efficacy and academic success, with students' success in one academic year leading to increased self-efficacy and subsequent success in following years.

Zimmerman (2000) noted that self-efficacy is not the only factor influencing academic success, and that even if students have high self-efficacy, it is not possible for them to achieve success if they lack knowledge and skills. Furthermore, Hassan et al. (2022) emphasized that metacognitive awareness has a significant effect on success. Therefore, in this study it can be assumed that both the self-efficacy and metacognitive features of the participants have a positive effect on their academic success.

The aim of the study was to investigate the potential mediating role of self-efficacy in the relationship between metacognition and academic performance. The findings suggested that general self-efficacy partially mediated the relationship between metacognition and academic success. This conclusion is supported by previous research in the field. Stephanou and Tsoni's (2019) study of 165 middle school students in fifth and sixth grade found that general self-efficacy played a mediating role in the relationship between metacognition and scholastic success. Therefore, the results suggest that students with higher levels of metacognitive awareness and strong self-efficacy beliefs are likely to achieve better academic outcomes.

CONCLUSION and RECOMMENDATIONS

The study emphasizes the significance of metacognition and self-efficacy for academic success. Metacognition is the capacity to think about and analyze one's own cognitive processes and learning strategies, while self-efficacy is the confidence in one's ability to effectively perform a task. The study's results indicate that both metacognition and self-efficacy play crucial roles in enhancing academic success. In addition, the study suggests that general self-efficacy mediates the connection between metacognition and academic success.

The emphasis on promoting metacognitive and self-efficacy perceptions has significant implications for higher education policy. Universities and colleges may need to re-evaluate their curricula and teaching methods to ensure that they are providing students

with opportunities to develop these skills. This may involve increasing the use of group work and self-reflection tasks, as well as providing more feedback and support to students. Additionally, institutions may need to provide more resources for tutoring programs, self-efficacy courses, and communication programs to help students improve their confidence and expectations of self-efficacy.

Another important implication is the need for further research into individual factors associated with metacognition and self-efficacy. This research can inform the development of evidence-based policies and programs that support students in their academic success. It may also be necessary to examine the relationship between metacognition, self-efficacy, and other factors, such as motivation and resilience, to develop a more comprehensive understanding of what contributes to student success.

Overall, the findings of this study suggest that higher education institutions should take a more holistic approach to supporting student success. This may involve a shift away from traditional, content-focused teaching methods and towards more student-centered, skills-focused approaches that emphasize metacognitive and self-efficacy development. By doing so, institutions can better equip students with the tools they need to succeed academically and in their future careers.

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Biographical notes:

Deniz Koyuncuoğlu: Assistant Professor at Kırklareli University. She received her undergraduate, graduate and doctorate degrees from Selcuk University, Department of Production Management and Marketing. Her research area focuses on leadership, innovation, techno-entrepreneurship, start-up universities and marketing in the context of higher education.

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Ethics statement: I hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. Prior to completing the survey, participants were informed about their rights through informed consent forms. I take full responsibility for the content of the paper in case of dispute.

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Research

Understanding The Relationship Between Self-Control and Grit: The Mediating Role of Academic Motivation and Attention Control

Hayri Koç[1] **Zeynep Şimşir Gökalp**[2]

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Abstract:

Over the past several decades, the psychological concepts of self-control and grit have gained prominence in the research literature. While these constructs have been studied extensively in isolation, there has been growing interest in understanding the relationship between the two constructs and the factors that mediate this relationship. The current study sought to examine the relationship between self-control and grit in a sample of 1079 undergraduate students (67.9% female) from twelve different state universities. Specifically, this study aimed to examine the mediating role of academic motivation and attention control in this relationship. Correlational analyses revealed that self-control and grit were positively associated with each other, as well as with academic motivation and attention control. Mediation analyses using bootstrapping procedures revealed that academic motivation and attention control partially mediated the relationship between self-control and grit. In other words, higher levels of self-control were associated with higher levels of academic motivation, which was associated with higher levels of grit. Similarly, higher levels of self-control were associated with better attention control, which was associated with higher levels of grit. These findings have important implications for understanding the components that contribute to the development of grit and suggest that interventions aimed at enhancing academic motivation and attention control may promote the development of greater grit in individuals.

Keywords: Self-control, grit, academic motivation, attention control, college students

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[1] Assist. Prof. Dr., Necmettin Erbakan University, Department of Guidance and Psychological Counseling, Türkiye. hayri5067@gmail.com , Orcid ID: 0000-0002-4589-8999
[2] Assist. Prof. Dr., Selçuk University, Department of Guidance and Psychological Counseling, Türkiye. zey.simsir.93@gmail.com , Orcid ID: 0000-0003-2353-8922

INTRODUCTION

Grit is a character trait that has attracted the interest of educational researchers and professionals over the last few decades (Credé et al., 2017; Credé, 2018). The term "grit" was first used by Duckworth and her colleagues, who defined it as an individual the inclination to have perseverance and passion for attaining long-term objectives. Grit has two unique components, including persistence in effort and consistency of interest (Duckworth et al., 2007). Grit, regarded as one of the most valuable non-cognitive indicators of academic performance (Duckworth et al., 2007), has evolved in conjunction with the positive psychology field (Kannangara et al., 2018). While grit is not associated with IQ, it has been shown to improve academic success, such as high school and college completion, and perseverance at the United States Military Academy (Duckworth et al., 2007). Similar findings were reported by other researchers. Individuals with higher levels of grit were found to have better academic performance (Hagger & Hamilton, 2019; Jiang et al., 2019), higher school engagement (Hodge et al., 2018; Li & Zhu, 2020), greater academic productivity (Hodge et al., 2018), higher effort on learning activities (Hagger & Hamilton, 2019), and higher academic-related goal commitment (Tang et al., 2021).

Several studies have revealed a relationship between the concept of grit and certain personal benefits in addition to academic success. Grit has a substantial positive correlation with resilience (Kannangara et al., 2018), well-being (Kannangara et al., 2018; Von Culin et al., 2014), mindset (Kannangara et al., 2018), life satisfaction, and peace (Şimşir & Dilmaç, 2022), harmony in life (Vainio & Daukantaitė, 2016), hope, and self-efficacy (Ekinci & Koç, 2022), happiness (Ekinci & Hamarta, 2020a; Singh & Jha, 2008), and work engagement (Suzuki et al., 2015). Ultimately, the literature suggests that grit is a positive trait that leads to favorable life outcomes.

Although grit has been recognized as a reliable indicator of life outcomes, its determinants and underlying mechanisms remain poorly understood. To put it another way, there is a gap in the literature that attempts to explain the fundamental process of grit. This research is focused on filling this gap. Self-control and motivation are conceptually the two fundamental psychological processes that underlie grit (Duckworth & Gross, 2014; Ekinci & Hamarta, 2020b, Von Culin et al., 2014; Wang et al., 2018). According to Seligman (2011), grit, an excessive type of self-control, may allow individuals to pursue long-term goals despite the temptations and distractions of short-term pleasures. In this context, we aimed to investigate the role of self-control, attention, and motivation in affecting grit in this study. We also formulated a mediation model based on theoretical explanations and empirical studies.

Grit has been primarily considered by personality researchers as a facet of the personality trait of conscientiousness (Lucas et al., 2015) as it is a component of the Big Five family of conscientiousness (Duckworth et al., 2007), and is highly associated with

conscientiousness (Ekinci et al., 2021; Ponnock et al., 2020). Some researchers also consider grit to be a form of courage (Maddi et al., 2012) and self-control (Duckworth & Gross, 2014). Self-control and grit are often used interchangeably, and these two factors are strongly correlated and predict success outcomes (Duckworth et al., 2007; Hagger & Hamilton, 2019; Ponnock et al., 2020). Although research has shown that self-control, other non-cognitive concepts, and grit are highly connected (Credé et al., 2017; Duckworth et al., 2007), their conceptual and empirical distinctions, as well as the extent to which they may differentially influence outcomes, have recently received attention (Duckworth & Gross, 2014). There is a paucity of empirical studies in the literature investigating the association between self-control and grit and the mechanism underlying this link. Therefore, in this investigation, we extend previous studies by empirically examining the cross-sectional links between grit and self-control, academic motivation, as well as attention control, and theoretically broaden the understanding of grit.

Conceptual and Theoretical Framework

Self-control and grit are characteristics related to effortful endurance in goal-directed activities (Hagger & Hamilton, 2019). Self-control refers to the ability to manage one's actions, emotions, and thoughts in order to accomplish higher-order goals (Baumeister et al., 2007; Inzlicht & Schmeichel, 2012). Even though immediate satisfaction may be more pleasurable, people with strong self-control make choices that are in consistent with their long-term objectives (Baumeister et al., 1998). Duckworth and Gross (2014) offered conceptual explanations for the distinction between self-control and grit. They suggested that people's ability to exercise self-control is linked to their capacity to inhibit their urges to act and regulate their behavior, such as resisting the temptation to indulge in tasty but harmful foods when dieting. These behaviors necessitate some effort to resolve the tension between goal-directed activities. On the other hand, grit involves taking deliberate actions to achieve greater, long-term objectives and organizing behavioral efforts in that direction. Grit requires persistent and tenacious effort toward a hierarchically organized objective despite challenges and failures, often overspending years or decades. Gritty individuals do not alter their course in the face of obstacles and disappointment (Duckworth et al., 2007). They are also inclined to manage their behavior and use their resources to resolve goal conflicts when they arise (Hagger & Hamilton, 2019). Therefore, gritty people consistently employ their capacity for self-control as they progress. In this sense, the process model of ego depletion may provide a useful theoretical foundation for explaining the relationship between self-control and grit (e.g., Inzlicht & Schmeichel, 2012; Milyavskaya & Inzlicht, 2018).

The process model of ego depletion is an alternative model that provides a more mechanical explanation of the resource model of self-control (commonly called the Strength Model; Muraven et al., 1998), which is one of the leading theories in the literature. The Strength Model was developed to investigate empirically the variability of sequential self-

control tasks across situations (Dvorak & Simons, 2009). The theory argues that self-control is an intrinsic capacity that is limited by the amount of internal resources or energy that can be used (Baumeister et al., 1998). This resource is prone to exhaustion over time, similar to how a muscle tires following action. As a result, after exerting self-control on one task, a person's ability to exercise self-control on subsequent tasks is diminished, which impairs their performance on further self-control tasks, such as managing emotions, completing puzzles, solving math problems, or making decisions (Baumeister et al., 1998). Additionally, self-control can be strengthened by consistent, small acts of self-control (Muraven et al., 1999).

There are some critical questions about the Strength Model, such as the nature of the resource and the process of ego depletion, despite the fact that it has highlighted an underappreciated aspect of self-control, served as a conceptual heuristic, and provided an organizing framework to comprehend a crucial characteristic of self-control resources (Hagger et al., 2010; Inzlicht & Schmeichel, 2012). The process model of ego depletion attempts to explain the specific cognitive, emotional, and motivational mechanisms of self-control and its depletion (Inzlicht & Schmeichel, 2012). According to this model, a reduction in motivational orientation and attentional focus is the cause of how exercising self-control at Time 1 reduces self-control at Time 2 (ego depletion). In other words, the shift in people's self-control ability over the course of successive self-control tasks is due to the change in their motivational orientation and attentional focus.

Motivation is the first significant process in the model. Lack of motivation contributes to the failure of self-control. Primary self-control strategies are able to shift people's motivation away from additional restraint and toward pleasure and enjoyment. Several studies have shown that increasing motivation and rewards can enable people to maintain self-control (e.g., Milyavskaya et al., 2015; Muraven & Slessareva, 2003). In this regard, we expect that academic motivation may play a mediating role in the association between self-control and grit. Academic motivation is referred to as an internal force that encourages and guides behavior targeted at accomplishing academic objectives (Pintrich & Zusho, 2002). It is the driving force that encourages an individual to attend school and succeed (Clark et al., 2014). Similarly, grit is a motivational concept that requires an individual to execute consecutive self-control duties in order to reach their long-term objectives (Duckworth & Gross, 2014; Schimschal et al., 2021). Motivation might reduce ego depletion of self-control and lead to more grit.

Attention is the second main focus of the model. Depletion impairs attention, causing it to shift from indicators of goal conflict and discrepancy to indicators of potential reward and pleasure. Following the self-control behavior, individuals experience a change in this monitoring mechanism, making them less sensitive to emotional and cognitive cues indicating a conflict or disparity between intended and actual states. Rather, they pay attention to and notice indicators related to pleasure and satisfaction (Inzlicht & Schmeichel, 2012). Furthermore, Milyavskaya and Inzlicht (2018) suggested that attention enhances self-

control in two possible ways: by getting the self-control conflict into cognitive awareness and by selectively highlighting the value sources of each option. Previous research has shown that self-awareness (self-focused attention) enhances the ability to exercise self-control (e.g., Alberts et al., 2011). Given these findings, we anticipate that attention control may play a mediating role in the relationship between self-control and grit.

Additionally, empirical studies in the literature have revealed associations between self-control, motivation, attention, and grit. For example, Pala and Başıbüyük (2023) reported that self-control and motivation are positively correlated and important predictors of achievement. The study conducted by Muenks et al. (2018) demonstrated that motivational variables are associated with grit and both predictors of academic success in students. Furthermore, attention control has been found to be positively related to both self-control (Stocker et al., 2020) and grit (Smith et al., 2020) in earlier studies. However, to the best of our knowledge, no study has ever been a study that investigated the connections between grit, motivation, attention, and self-control. This study will therefore contribute to the literature.

The Present Study

In this cross-sectional study, we aimed to investigate the relationship between self-control and grit among undergraduate students. Additionally, we aimed to test the conceptual model underlying this association. The mediation model established in this study is based on the process model of ego depletion, and the number of studies testing this model in the literature is quite limited (e.g., Haynes et al., 2016). Therefore, this study may contribute to testing the theory and filling a gap in the body of literature. As mentioned earlier, there is also a conceptual discussion regarding the connections and differences between the concepts of self-control and grit. This study might provide a novel and alternative perspective to this debate. Finally, we established the following hypotheses:

1. Self-control would positively predict grit.

2. Academic motivation and attention control would play a mediating role in the relationship between self-control and grit.

METHOD

Participants

In this study, we conducted a cross-sectional survey using a sample of 1079 undergraduate students (67.9% female) from twelve state universities in Turkey. The participants were from 49 different provinces across Turkey and their ages ranged from 17 to 39, with a mean age of 21.4 and a standard deviation of 2.13. The academic level of the participants was distributed as follows: 201 (18.6%) were in their first year, 280 (25.9%) were in their second year, 278 (25.8%) were in their third year, and 320 (29.7%) were in their fourth year. We distributed the online survey through social platforms such as Facebook and WhatsApp and requested participants to share it with others. Prior to data collection,

participants provided informed consent by agreeing to the content and purpose of the study. The survey was open for three weeks, and we closed it for responses once the time had expired.

Instruments

The Brief Multidimensional Self-Control Scale (BMSCS): The BMSCS is a self-report scale consisting of seven-item that are used to measure an individual's level of self-control, as developed by Nilsen et al. (2020). Participants respond to each item on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree" (e.g., "I focus daily on my long-term goals"). In a group of people from Turkey, it was discovered that the scale used in the study was found to have satisfactory internal consistency (Koç et al., 2023), and in this study, the internal reliability of the scale was also found to be acceptable with a Cronbach's alpha coefficient of .69.

Self-regulation Scale (SRS): The SRS is a seven-item self-report scale (Schwarzer, Diehl, & Schmitz, 1999) used to measure the level of attention control in goal pursuit. Participants rate each item using a Likert scale with four-point, where 1 represents "not at all true" and 4 represents "completely true" (e.g., "I can control my thoughts from distracting me from the task at hand"). The SRS demonstrated strong internal reliability in a Turkish sample according to Çevik et al. (2017). The scale demonstrated strong internal reliability in this study, as indicated by a Cronbach's alpha coefficient of .86.

Academic Motivation Scale (AMS): The AMS is a 20-item self-report scale (Bozanoğlu, 2004) used to assess levels of academic motivation. Each item is rated on a 5-point Likert scale ranging from 1, which means "strongly disagree," to 5, which means "strongly agree" (e.g., "As soon as the lesson starts, I pay attention to the lesson"). The academic motivation scale has been widely used in studies of different age groups in the Turkish sample (e.g., Bedel, 2013; Erzen & Çıkrıkçı, 2022; Hotaman & Yüksel-Sahin, 2010). The scale demonstrated strong internal reliability in this study, as indicated by a Cronbach's alpha coefficient of .92. The scale also has acceptable fit values ($\chi 2/sd = 3.5$, GFI = .92, RMSEA = .06, SRMR= .087).

The Short Grit Scale (Grit-S): The Grit-S is an eight-item self-report instrument developed by Duckworth and Quinn (2009) to measure an individual's level of grit. Participants answer the questions on a 5-point Likert scale ranging from "not at all like me" to "very much like me" (e.g., "I have a hard time focusing on projects that take more than a few months to complete"). The scale was found to have acceptable internal reliability estimates in a Turkish sample (Sarıçam et al., 2016) and an internal reliability estimate of .64 in the current study.

Data Analyses

To test the mediation of academic motivation and attention control in the relationship between self-control and grit, we used version 3.5 (Model 4) of the PROCESS macro in SPSS, following the guidelines outlined by Hayes (2018). The analysis was based on 5000 bootstrapped samples with a 95% confidence interval, and significance was determined using the criterion that the confidence intervals do not include zero in bootstrapping, as suggested in the literature (Preacher & Hayes, 2008).

Ethical considerations

In this study, all rules stated to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics", which is the second part of the directive, were taken.

Ethical review board name: Selcuk University Faculty of Education Ethics Committee

Date of ethics review decision: 20.03.2023

Ethics assessment document issue number: 50

RESULTS

Preliminary Analyses

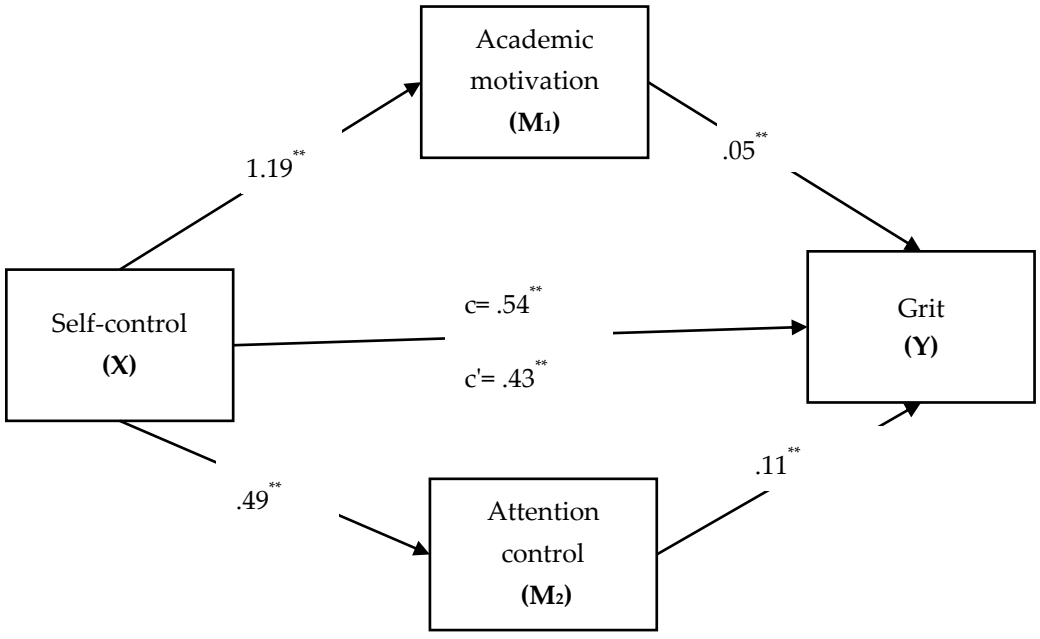
Table 1 presents the correlations and descriptive statistics among the variables. Initial analysis indicated that the variables had acceptable distributional characteristics for further analysis, with skewness and kurtosis values ranging from -.18 to .66 and being less than 2 in absolute value. Correlation analysis revealed significant positive associations between self-control and academic motivation, attention control, and grit. In addition, academic motivation was significantly and positively associated with attention control and grit, while attention control also showed a significant positive association with grit.

Table 1

Correlations and Descriptive Statistics Among the Study Variables

Variable	1	2	3	4	M	SD	Skw	Kurt	Min	Max
1. Self-control	-				26.13	4.97	.02	.33	9	40
2. Academic motivation	.42**	-			67.80	14.05	-.18	-.17	24	100
3. Attention control	.56**	.50**	-		19.73	4.28	-.01	-.13	7	28
4. Grit	.60**	.42**	.46**		26.74	4.49	.20	.66	11	40

Note: $^{**}p < .001$,



Note: $^{**}p < .001$.

Figure 1. Mediation Model of Study Variables

The results of the mediation analysis illustrating the relationships between self-control, academic motivation, attention control, and grit, are presented in Figure 1. First, the

results of our study supported Hypothesis 1, as self-control was found to have a positive direct effect on grit (B = .42, p < .001). As can be seen in Table 2, academic motivation mediates the relationship between self-control and grit (B = .06, 95% CI [.04 - .09]). In addition, attention control plays a mediating role in the relationship between self-control and grit (B = .06, 95% CI [.02 - .09]). Thus, our results provide evidence for Hypothesis 2.

Table 2

The Direct and Indirect Effect of Self-Control on Grit.

Path	Coefficient	95% CI	
		LL	UL
Direct effect			
Self-control➔ Grit	.42**	.37	.48
Indirect Effect			
Self-control➔ Academic motivation ➔ Grit	.06**	.04	.09
Self-control➔ Attention control➔ Grit	.06**	.02	.09
Total indirect effect	.12**	.09	.15
Total effect	.54**	.50	.59

Note: $^{**}p < .001$

DISCUSSION

The grit literature began to develop with an article published by Duckworth and colleagues in the Journal of Personality and Social Psychology in 2007 (Duckworth et al., 2007). Since then, the topic of grit has gained popularity in the field of psychology, and the number of studies on grit has grown rapidly (Credé, 2018). Grit has also gained interest as a potential intervention topic due to its importance in achieving success in school, the workplace, and personal endeavors (e.g., Ekinci & Hamarta, 2020a; Hagger & Hamilton, 2019; Suzuki et al., 2015; Şimşir & Dilmaç, 2022). Despite these benefits, the grit literature suffers from several significant theoretical and empirical concerns, including a lack of construct validity and discriminant validity (Credé et al., 2017; Credé, 2018; Vazsonyi et al., 2019). For example, a recent meta-analysis suggested that grit researchers have fallen victim to the jangle fallacy because grit may simply be a renamed form of conscientiousness (Credé et al., 2017). Similarly, grit and self-control are strongly correlated and both contribute to academic achievement (Duckworth et al., 2007; Hagger & Hamilton, 2019). However, Duckworth and Gross (2014) characterized grit as a non-cognitive trait that is linked to, but different from, self-control and conscientiousness. Although they accepted the relationship between grit and self-control, they also provided a rationale for why grit was both unique

and different from self-control. Empirical research is needed to comprehend the link between self-control and grit, as well as the underlying mechanisms that drive this relationship as the arguments presented are primarily conceptual in nature. In this study, we investigated the association between self-control and grit, as well as the mediating effects of attention control and academic motivation.

The results of our study confirmed the existing research by demonstrating a strong relationship between self-control and grit (e.g., Duckworth et al., 2007; Kannangara et al., 2018; Ramos Salazar & Meador, 2023; Şimşir & Dilmaç, 2022; Vazsonyi et al., 2019). In other words, the capacity for self-control has a positive effect on the level of grit. For example, Vazsonyi et al.'s (2019) study with university students showed a high level of positive correlation between grit and self-control. Using structural equation modeling, Vazsonyi et al. (2019) carried out extensive model testing and presented evidence of considerable overlap between grit and self-control. The authors noted that the model analyzing the structure of the two concepts had a strong correlation coefficient. Furthermore, the meta-analysis study by Crédé et al. (2017) indicated that grit has a very high correlation with self-control.

Supporting our second hypothesis, we found that attention control and academic motivation played a mediating role in the association between self-control and grit. These findings may have theoretical implications for how self-control affects grit. The indirect effect of self-control on grit through attention control and academic motivation is consistent with the resource model of self-control proposed by Inzlicht and Schmeichel (2012). The process model of depletion, based on a sequential task paradigm, argues that exerting self-control at Time 1 results in temporary changes in motivation and attention that weaken self-control at Time 2. Motivational and attentional changes are interdependent and recurrent processes. People may be less aware of cues indicating the need for restraint and more aware of cues indicating reward when they are less motivated to regulate and more eager to indulge. In other words, motivation overcomes the depletion effect and increases self-control performance at Time 2. Motivated individuals focus their attention on long-term goals and cues that signal control rather than on rewards and gratification. Considering that grit requires successive self-control tasks aligned with hierarchical goals (Duckworth & Gross, 2014), the mediating role of academic motivation and attention control can be better understood.

A growing body of research shows that motivation decreases impulsivity toward goal-interfering temptations (Milyavskaya et al., 2015) and enhances self-control when pursuing goals (Muraven & Slessareva, 2003; Vohs et al., 2012). An experimental study by Vohs et al. (2012) demonstrated a significant improvement in self-control in multiple self-control tasks. Furthermore, several researches literature have shown that motivation is positively related to both self-control (Pala & Başıbüyük, 2023) and grit (e.g., Muenks et al., 2018; Yıldız & Kardaş, 2021). In summary, the mediating role of motivation in the link between self-control and grit is consistent with previous studies.

The ability to control attention is another mechanism that enables people to successfully engage in sequential self-control activities. The ability to maintain self-control tasks can be strengthened by directing attention to goals rather than rewards and pleasures (Inzlicht & Schmeichel, 2012). Duckworth and colleagues also emphasized attention processes in their process model of self-control (Duckworth et al., 2019). According to the process model of self-control, attentional deployment strategies direct an individual's attention to aspects of the environment that promote, rather than weaken, self-control. For example, a student might intentionally direct attention to their math textbook while resisting the urge to use social media by looking away from their smartphone (Duckworth et al., 2019). Thus, focusing individuals' attention on actions that will help them achieve their long-term goals rather than on immediate gratification may improve their self-control performance and contribute to their grit.

LIMITATIONS AND FUTURE STUDIES

Despite its strengths, the current study has some inherent weaknesses. First, the cross-sectional approach used in the study does not allow for the establishment of causality between the variables examined. To overcome this limitation, longitudinal study designs that assess grit, motivation, and self-control over the course of several months or years would be crucial. Such designs would allow for a more effective assessment of the pattern of effects, including both directional and reciprocal effects, as well as modeling of changes in these variables over time. Second, the participants in the study were limited to undergraduate students enrolled in college in a major city in Turkey. More extensive research could be conducted with the participation of college students from different provinces of Turkey and students from other grade levels (i.e., middle school and high school) to increase the generalizability of the research findings. Third, since all the data were self-reported and collected through an online survey, there may be bias due to the tendency of participants to respond in a certain way. Lastly, future studies should use alternative study designs and methods, such as laboratory-based and experimental research, to evaluate the process model of ego depletion.

CONCLUSION

This study provides empirical support for the significant relationship between self-control and grit, despite various limitations. The research also establishes a mediation model that reveals the mediating role of academic motivation and attention control in the relationship between self-control and perseverance. This model, based on the ego-depletion process theory, provides an alternative perspective for understanding the relationship between self-control and grit, as well as helps to test the process model of depletion, which currently lacks adequate empirical support. Overall, the results of this study may provide new insights for researchers in the field.

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Biographical notes:

Hayri Koç received his doctoral degree in Counseling Psychology from Necmettin Erbakan University in 2020. He is currently an Assistant Professor, working at the Faculty of Education at Necmettin Erbakan University. His research interests are positive psychology, cognitive psychology, selfcontrol, and school counseling.

Zeynep Şimşir Gokalp received her doctoral degree in Counseling Psychology from Necmettin Erbakan University in 2020. She is currently an Assistant Professor, working at the Faculty of Education at Selcuk University. Her research interests are positive psychology, posttraumatic growth, selfcontrol, and school counseling.

Author(s)' statements on ethics and conflict of interest

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Research

Challenges and Opportunities of Meta-Analysis in Education Research

Nathaniel Hansford [1] **Rachel L Schechter** [2]

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Abstract:

Meta-analyses are systematic summaries of research that use quantitative methods to find the mean effect size (standardized mean difference) for interventions. Critics of meta-analysis point out that such analyses can conflate the results of low- and high-quality studies, make improper comparisons and result in statistical noise. All these criticisms are valid for low-quality meta-analyses. However, high-quality meta-analyses correct all these problems. Critics of meta-analysis often suggest that selecting high-quality RCTs is a more valid methodology. However, education RCTs do not show consistent findings, even when all factors are controlled. Education is a social science, and variability is inevitable. Scholars who try to select the best RCTs will likely select RCTs that confirm their bias. High-quality meta-analyses offer a more transparent and rigorous model for determining best practices in education. While meta-analyses are not without limitations, they are the best tool for evaluating educational pedagogies and programs.

Keywords: Meta-Analysis, RCTs, Best Practice, Evidence-Based, Evaluating Pedagogy

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[1] Nathaniel Hansford, Canada, nathaniel.hansford@gmaill.com, Orcid ID: 0009-0002-2873-8149

[2] Dr. Rachel Schechter, LXD Research, USA Rachel@LXDresearch.com, Orcid ID: 0000-0001-9061-2892

INTRODUCTION

It is a common public/layman conceptualization for science that research results consistently show contradictory findings. This might partly stem from the media's poor reporting on new research. The media tends to report on each new landmark study, as if it stands in a vacuum, as the sole edict, to what science proves. This is problematic because it assumes the newest study is always the most correct, rather than looking to see what the majority of research shows. In the past, researchers would complete systematic literature reviews to discover the scientific consensus on a topic. With this approach, a researcher reads all the studies on a topic and then writes about their findings. This can be problematic because it tends to be purely qualitative, and the researcher gets to present their interpretation, without being beholden to any quantitative data.

A meta-analysis is similar to a literature review, except the authors also find the average statistical result for studies on a topic. Typically, meta-analysis results are displayed in effect sizes, an equation that seeks to create a standardized mean difference, so we can compare multiple studies. Looking at research through meta-analysis is the most systematic way of examining research. The author must review all studies, and then systematically synthesize quantitative results. Ideally, this removes as much bias as possible and provides an interpretation of the most normalized result on a topic. Meta-analysis also serves a fundamental scientific principle, replication. A scientific finding is only truly valid if it can be consistently replicated. Using meta-analysis, we can be sure whether a finding has been well replicated. Replication is especially important in education research because scientific results tend to be more variable, and experiments are often carried out by those selling pedagogical products.

Over the last two decades, meta-analyses have been crucial in helping to determine what best practice in literacy instruction is. Most famously, the National Reading Panel conducted multiple meta-analyses, including one that compared systematic phonics and whole language instruction. Their research showed systematic phonics has a mean effect size of .44 (NRP, 2001). This is why many reading researchers today recommend systematic phonics instruction as part of a comprehensive literacy program.

Some scholars object to meta-analysis, and they usually cite three main arguments:

1. Meta-analysis ignores study quality.
2. Meta-analysis makes apples-to-oranges comparisons.
3. Meta-analysis tends to show random statistical results, but not meaningful results.

1. Quality

There are typically 4 main types of studies included in a meta-analysis.

1. Case studies: studies without control groups or done retrospectively
2. Correlation studies: studies that look at the correlation between two datasets
3. Quasi-experimental studies: studies that have a non-randomized treatment and control group
4. Randomized Control Trial (RCT): studies with randomized treatment and control groups.

Typically, an RCT is seen as a higher quality study than a quasi-experimental study, and a quasi-experimental study is seen as higher quality than a case study. Sample size, duration, fidelity tracking, attrition, and measurement also affect the quality of a study. Typically, higher-quality studies show, on average, lower results. For example, a large sample size, long duration RCT with standardized measurements, is far more accurate than a small, short-duration case study that uses researcher-designed assessments.

Meta-analyses that do a poor job of controlling quality will typically include studies with varying levels of quality, such as case studies and RCTs, and report on one mean effect size. A well-done meta-analysis will either exclude low quality studies or show the difference in results for high versus low quality studies. For example, look at this result section from a fantastic meta-analysis by (Fritton, 2018).

Table 1

Fritton 2018 Sensitivity Analysis

Overall effect size estimation and sensitivity analyses

Constraints	Effect size	*SE*	*t*	*df*	*p* value	CI lower bound	CI upper bound	*n*	*k*	τ^2	Assumed ρ	Q_E	I^2
Full sample (*r* = .70)	0.28	0.05	5.69	53	<.001	0.18	0.38	226	54	0.09	.70	253.83	79.12
No within-group comparisons	0.42	0.16	2.62	17	.018	0.08	0.76	65	18	0.38	.70	136.66	87.56
Only BAU control conditions	0.27	0.11	2.54	12	.026	0.04	0.51	45	13	0.10	.70	31.82	62.29
No studies without RA	0.47	0.30	1.56	8	.158	−0.22	1.16	30	9	0.64	.70	115.93	93.10
Full sample (*r* = .80)	0.30	0.05	6.00	53	<.001	0.20	0.40	226	54	0.10	.70	343.14	84.55
Full sample (*r* = .90)	0.32	0.05	6.14	53	<.001	0.22	0.44	226	54	0.11	.70	666.17	92.04
Only standardized outcome measures (*r* = .70)	0.17	0.04	4.15	38	<.001	0.09	0.25	143	39	0.04	.70	100.23	62.23
No within-group comparison	0.35	0.13	2.61	13	.022	0.06	0.64	44	14	0.25	.70	75.00	82.67
Only BAU control conditions	0.37	0.11	3.18	10	.010	0.11	0.62	36	11	0.09	.70	24.28	58.81
No studies without RA	0.31	0.30	1.02	4	.366	−0.53	1.14	13	5	0.50	.70	50.35	92.06
r = .80	0.17	0.04	4.62	38	<.001	0.10	0.25	143	39	.04	.70	116.49	67.38
r = .90	0.19	0.04	5.31	38	<.001	0.12	0.26	143	39	.04	.70	174.99	78.28
Only experimenter-created outcome tools (*r* = .70)	0.34	0.09	3.81	26	.001	0.16	0.53	83	27	0.14	.70	206.61	87.42
No within-group comparison	0.34	0.45	0.76	5	.481	−0.82	1.50	21	6	0.83	.70	96.94	94.84
Only BAU control conditions	−0.04	0.16	−0.26	2	.821	−0.73	0.65	9	3	0.07	.70	3.95	49.37
No studies without RA	0.40	0.55	0.72	4	.509	−1.13	1.94	17	5	0.98	.70	96.00	95.83
r = .80	0.37	0.09	4.05	26	<.001	0.18	0.56	83	27	0.14	.70	285.36	90.89
r = .90	0.43	0.10	4.16	26	<.001	0.22	0.65	83	27	0.16	.70	574.41	95.47

Note. *SE* = standard error; *df* = degrees of freedom; CI = 95% confidence interval; *n* = effect sizes; *k* = studies; τ^2 = estimated variance in effect sizes across studies; ρ = assumed correlation between scores in within-group designs; Q_E = weighted sum of squares on a standardized scale; I^2 = index of the magnitude of heterogeneity between studies; RA = random assignment; BAU = business-as-usual.

In this study, the authors used the above sensitivity analysis to show the mean effect size changed across varying levels of quality. Interestingly, the highest quality studies showed a similar effect size (.31) to the overall mean for the study (.28), suggesting that quality did not significantly impact results, an unusual finding.

2. Apples to Oranges

"Apples to Oranges" is often used as a metaphor for comparisons that are too dissimilar to be meaningful. Within the context of meta-analysis, an example could be drawn from trying to find the mean effect of comprehension instruction and including multiple types of comprehension instruction together, as if they were the same thing. For example, vocabulary and strategy instruction are used to teach comprehension, but they are very different approaches. That said, good meta-analyses control for this by separating the results as moderator variables, as can be seen in Table 2 (Filderman, 2022). Moderator analysis can show what is the mean effect size for different types of studies, or outcomes. For example, a moderator analysis could differentiate between the effect sizes of RCTs, quasi-experimental studies, and case studies. In contrast, multilevel modeling and regression analysis can be used to estimate the impact of multiple moderator variables at once. As can be seen in Table 3.

Table 2

Filderman Sensitivity Analysis

Variable	No. of ES	No. of studies	*df*	*g*	95% CI	Between-study sampling variance (τ^2)	*p*
Participant characteristics							
Upper elementary	126	25	45.96	0.47	[0.31, 0.63]	0.17	<.001
Secondary	185	30	43.14	0.67	[0.46, 0.87]	0.43	<.001
Intervention characteristics							
Text type							
Narrative	40	7	11.83	0.31	[−0.01, 0.62]	0.23	.06
Expository	168	25	41.08	0.72	[0.51, 0.93]	0.30	<.001
Both	59	13	14.19	0.34	[0.16, 0.53]	0.08	.001
Interventionist							
Researcher	171	27	50.26	0.53	[0.35, 0.70]	0.30	<.001
Teacher	120	25	37.88	0.69	[0.44, 0.93]	0.34	<.001
Instructional approach							
Strategy instruction							
Main idea	215	37	53.2	0.72	[0.54, 0.89]	0.30	<.001
Inferencing	73	15	22.54	0.56	[0.32, 0.81]	0.18	<.001
Text structure	99	17	27.44	0.47	[0.24, 0.70]	0.25	<.001
Retell	54	11	18.95	0.59	[0.29, 0.90]	0.31	<.001
Predicting	86	19	28.1	0.60	[0.39, 0.81]	0.25	<.001
Strategy only	173	33	50.48	0.69	[0.47, 0.90]	0.39	<.001
Multiple strategies	164	30	45.48	0.59	[0.41, 0.76]	0.24	<.001
Background knowledge (BK)							
Vocabulary	126	21	31.15	0.39	[0.26, 0.51]	0.10	<.001
Content knowledge	92	14	23.62	0.64	[0.35, 0.93]	0.37	<.001

Table 3

Regression Analysis Example

Cognitive Strategy/Skill Regression Analysis:

Number of Effects	Mean Effect Size [95% CI]	Fixed Effect	Standardized Assessment	Randomized
7	.50 [-.47, .49]	x	x	x
17	.20 [.05, .36]		x	x
4	.53 [-.39, 1.46]	x		x
		x	x	
17	1.72 [1.0, 2.40]			x
3	.04 [-1.15, 1.24]	x		
2	.33 [-2.14, 2.81]		x	
3	.37 [-.26, 1.01]			

2. Statistical Noise

One less common criticism of meta-analysis is that the authors capture random effects and averages, not meaningful trends. Let's make a hypothetical example. Say we have 10 studies, and they show the following effects: .10, .20, .30, .40, .50, .60, .70, .80, .90, 1.0, you will find a mean effect size of .50, which is quite significant. However, there is no average discernible trend within those studies. So by taking the mean, we have actually made the data less meaningful, as opposed to more meaningful. Of course, there are multiple tools for addressing this issue. Most typically, meta-analyses will use confidence intervals, which show the likely range of results between effect sizes, and or p values, which display the likelihood that a statistic is random, alongside their mean effect sizes so that readers can discern if the mean effect found was meaningful or random noise. Indeed, if you look back at the two graphics from well-done meta-analyses, they both included confidence intervals and p values alongside their effect sizes.

So, Are these Criticisms Valid?

All three of these criticisms are valid. However, they also only really apply to a poorly done meta-analysis. Meta-analysis is a relatively new technique for reviewing research, and it has evolved over the last 20 years. If you read meta-analyses done in the late 90's, they often combine multiple poor-quality studies to produce one mean effect size. While more modern meta-analyses tend to be much more sophisticated, there is a lack of consistency within the field of education for meta-analysis methodology. For example, we reviewed meta-analyses on the topic of ESL education. We found 12 meta-analyses on ESL education

research, dating back to 2009 (all of which can be found in the references section). Of these 12 meta-analyses, 6 included studies without control groups and did not use moderator analysis to compare the impact of studies with and without control groups. The 6 meta-analyses that did not control quality were not rigorous and, therefore, cannot be used as a definitive proof for the scientific consensus.

THE ALTERNATIVE

Those who criticize meta-analysis often claim we should rely on high-quality RCTs instead. This is a problematic solution for two reasons. Firstly, researchers independently decide which RCTs are the most rigorous using complex processes. For example, many scholars have cited Balanced Literacy as the gold standard of reading instruction, based on a handful of RCTs reviewed by WWC (Hechinger, 2022). This suggestion was made in comparison to the findings of the NRP meta-analysis, which recommended systematic phonics instruction, based on dozens of studies.

Secondly, this methodology is based on the belief that well-done RCTs show precise outcomes and therefore do not need replication. But within the field of education, this is undoubtedly false. Let's look at some of the findings from the (Hansford, 2022) meta-analysis on language programs. There were 20 identified RCTs that looked at structured literacy phonics programs. The mean effect size was .48, and the 95% confidence intervals were [.31, .66]. We can expect results of .31 to .66 in 95% of structured literacy RCT studies. This is a pretty wide range. .66 is a moderate to high effect size, and .31 is low. The lowest study showed an effect size of -.11 (Vaden-Kiernan, 2008). And the highest effect size was 1.16 (Farokhbakht, unlisted date). Neither effect size is particularly representative of the normal effect of a phonics intervention. However, a scholar with an agenda could point to either study to make a case for or against structured literacy.

The Vaden-Kiernan study is of far higher quality than the Farokhbakht study. If we examine the highest quality RCT studies, in this case, longitudinal RCTs with standardized assessments. We get 3 studies: (Vaden-Kiernan, 2008), (Torgesen, 2007), and (Bratsch, 2020). These studies showed a mean effect size of .22, with 95% confidence intervals of [-.50, .95], suggesting a high degree of variability. The lowest study showed a mean effect size of -.11, and the highest study showed a mean effect size of .43 (Bratsch, 2020). Again, a biased academic could pick any of those three studies and argue for or against phonics/structured literacy.

All of these studies could also be apple-to-oranges comparisons, as each study looked at different demographics, programs, and styles of approaches. One study looked at a scripted DI approach (Vaden-Kiernan, 2008). One study looked at an Orton Gillingham approach (Torgesen, 2007). And one study looked at a speech-to-print approach (Bratsch, 2020).

However, we also see very different results even if we only look at RCT studies on the same program. For example, let's look at Read 180. In 2022 Hansford and Mcglynn identified 12 RCTs on Read 180, with a mean effect size of .11 and 95% confidence intervals of [.04, .19]. Here the confidence intervals suggest a very narrow range. However, the highest effect size study (Interactive Inc, 2002) showed a mean effect size of .41, and the lowest effect size study (Fitzgerald, 2008) showed a mean effect size of 0 (for longitudinal outcomes). If we remove all the lowest quality studies and only include those that used standardized measurements, were longitudinal, and controlled for fidelity, we get 4 studies, (Interactive Inc 2002), (Fitzgerald, 2008), (Meisch, 2011), and (Sprague, 2012). Together the studies show a mean effect size of .16, but the confidence intervals are much wider than when all 12 RCTs are included, [-.12, .40].

Moreover, both the (Fitzgerald, 2008) study and the (Interactive Inc, 2002) study were within the highest quality category. Hence, the range of effect sizes was still 0-.41. If we look at both quasi-experimental and RCT studies, 13 out of 19 mean effect sizes were between 0 and .29. With 95% confidence intervals of [0, .19]. While looking at all the studies together suggested a very consistent trend of a low effect, looking at only the highest quality studies made the found effect appear more random, and difficult to find a meaningful trend.

That said, the Read 180 studies, covered multiple grades and used different designs. Reading Recovery might be a better example. Within the (Hansford, 2022) meta-analysis of Language programs, we identified 11 RCT studies on Reading Recovery, all of which looked at the identical grade. Moreover, all but two used the same basic design, comparing 1-on-1 intensive reading instruction for 20 weeks, to a no-treatment control group. These 11 studies showed a mean effect size of .38, with 95% confidence intervals of [-.99, 1.24] (outliers included). All these studies are RCTs on the same grade and same program. All but 2 of these studies compared no treatment to treatment. And yet, a large range of effect sizes were found. The largest impact was found in (Iverson, 1999), with a mean effect size of 2.59, and the lowest was (Schmitt, 2004), with a mean effect size of -.50. Again, any scholar with an agenda could pick either RCTs and make the opposite arguments. Even if we take the two highest quality studies, in this case (Holliman, 2013) and the (Center for Research in Education and Social Policy, 2022), we still get opposite results. Both studies were large-scale longitudinal RCTs. (Holliman, 2013) showed a mean effect size of .48, and the (CRESP, 2022) study showed a mean effect size of -.19.

Inconsistent findings among RCTs create a sentiment that education science produces inconsistent findings and cannot be trusted. Again, any scholar with an agenda could pick either of these RCTs and make completely opposite arguments. Scholars on either side of the reading wars debate will likely want to point to the flaws in either study as a defense for their perspective. Indeed, pro-Reading Recovery scholars frequently point to the (Holliman, 2013) study as evidence that Reading Recovery works, and pro-structured literacy advocates frequently point to the (CRESP, 2022) study, including Emily Hanford. Both the Holliman and CRESP study have weaknesses. The Holliman study had poor fidelity controls in the

control group, and the CRESP study had high attrition rates. Both studies compared intensive 1-1 reading instruction to no additional instruction, which is not an ideal study design. That said, the studies are both of higher-than-average quality compared to other studies in the Hansford 2022 meta-analysis.

Of course, instructional programs include multiple variables at once and are often compared to business-as-usual control groups. For this reason, it might be easier to isolate the fixed effect of a pedagogy than a program. (Bakken, 1997) and (Boyle, 1993) conducted RCTs, on the effects of cognitive strategies on reading comprehension for intermediate students with learning disabilities. Both studies used active control groups, in which instruction was the same as in the treatment group, minus the instruction on cognitive strategies. Both studies used standardized assessments. Both studies had a sample of between 30-40 students. Both studies were short and lasted less than a month. However, in the Bakken study we found an effect size of 2.71 for the use of cognitive strategies and in the Boyle study we found an effect size of .15. Both studies were of extremely high quality and similar, and yet, they yielded completely different results. The above-discussed anomalies suggest that even the highest quality RCTs do not lead to precise or consistent results and that even a very high-quality RCT cannot be considered reliable evidence of efficacy in isolation.

Do Meta-Analyses Provide More Homogenous Effects?

While the above research suggests that RCTs do not provide homogenous results, this does not necessarily mean that meta-analyses do. Indeed, many meta-analyses at face value appear to show very different results, for similar research questions. As of 2023, we can identify at least 14 peer-reviewed and experimental meta-analyses, conducted on English phonics instruction. (Camilli, 2003) identified the lowest effect size of .24. Conversely, (Weiser, 2011) found the highest effect size of .78. These differences are seemingly very different; however, these meta-analyses examined very different questions. (Camilli, 2003), attempted to identify the fixed effect of systematic phonics versus unsystematic phonics, and (Weiser, 2011) was attempting to identify the random effect of encoding instruction. These research questions are fundamentally different. Comparatively, (Steubings, 2008), which had the same research question as Camilli, found a mean effect size of .31, which is statistically comparable. Similarly, (Hansford, 2022), (Piasta, 2011), (Ehri, 2001), and the (NRP, 2001) all looked at the random effect for general phonics instruction and found a mean effect size of between .40 and .45 for phonics, suggesting a very homogenous effect. While, meta-analyses often produce heterogeneous effects, these differences usually have to do with the research question and methodology used.

Meta-analyses also have unique advantages for detecting outlier data. It is impossible to tell if the results from a single RCT represent outlier data when taken in isolation. However, tools like funnel plots, trim and fill, and IQR analysis, can be used within a meta-analysis to identify if a single study is an outlier (Terrin, 2003). Funnel plots

can be especially useful in visualizing whether there is outlier data related to sample size. Small sample size studies often have larger effect sizes, partly because it is harder to effectively implement a new pedagogy with a larger group of teachers. Smaller sample size studies can also produce more random results, as individual outliers can have a greater impact (IntHout, 2015). Lastly, smaller sample size studies can be more easily replicated and used to "fish" for better results (Lee, 2012). Funnel plots are commonly used to compare the results of studies with the sample sizes of studies, to test whether smaller sample size studies increase heterogeneous effects. To help illustrate this point, we created a scatter plot of RCT studies on Read 180, based on the (Hansford, 2022) meta-analysis of Read 180. The results can be seen in Figure 1.

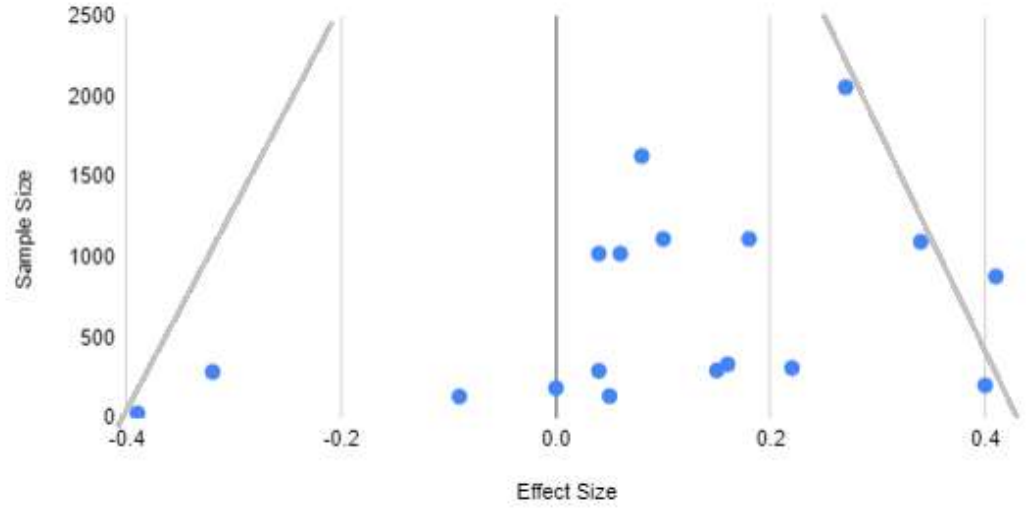

Figure 1: *Read 180 Funnel Plot*

Figure 1 shows that the negative effect sizes were associated with low sample size studies, suggesting that these low sample sizes led to more random and, thus, more heterogeneous results. Similarly, the two highest effect sizes found were both associated with studies that also had study samples below the median sample size. According to Cohen's guide, most studies with a sample size above 1000 fell between the effect size range of 0-.20, suggesting a negligible outcome. This meta-analysis tool allows readers and researchers to better understand what an expected outcome might be for a pedagogy or program than any single RCT could provide.

IMPLICATIONS FOR PRACTICE

Whether trying to measure the efficacy of a principle, or a program, it is incredibly difficult to find a consistent effect found across multiple RCTs. This difficulty stems from the fact that education is not a hard science, it is a social science. There is a large degree of variability in research results. Teacher quality, student motivation, demographics, study

design, and study quality will all impact the effect size. Controlling all these variables consistently is nearly impossible. You, therefore, cannot expect results to be static across multiple studies. It is not rational to expect individual RCT studies to produce results that do not vary.

Even if high-quality RCTs did show consistent results, isolating the highest-quality RCTs is very difficult and requires people to make unbiased judgments. People are likely to be more critical of the studies that do not confirm their biases and less critical of the ones that do. We can only truly avoid cherry-picking results to support our biases by reviewing all of the relevant studies on a topic. This does not mean viewing all studies uncritically, instead a good meta-analysis uses objective criteria to identify how effect sizes varied according to study quality. Moreover, when factors limit the validity of a meta-analysis, such as a lack of studies with control groups, the authors should identify it as a limitation. Using methodologies like moderator variable analysis, regression analysis, and multilevel modeling, with meta-analysis is a far more transparent process than simply trying to select the most valid study.

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Biographical notes:

Nathaniel Hansford: Nathaniel Hansford is a teacher of 11 years. He holds a specialist qualification in both reading and special education. He is the author of two education books and is the lead writer for Pedagogy Non Grata. Contact Nathaniel: Nathaniel.hansford@gmail.com

Dr. Rachel Schechter: Is the founder of (LXD) Research and has led education research teams since 2007; she was previously the Vice President of Learning Sciences at HMH. Dr. Schechter holds a doctorate in Child Development from Tufts University and a Master from Harvard University.

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