International Journal of Education & Literacy Studies
ISSN: 2202-9478
www.ijels.aiac.org.au

The Effects of Neuroscience-Based Mindfulness Training on Adolescents

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ARTICLE INFO

Article history
Received: June 31, 2023
Accepted: September 22,2023
Published: October 31, 2023
Volume: 11 Issue: 4

Conflicts of interest: None
Funding: None

Note: The initial findings of this study were presented at the 23rd International Psychological Counseling and Guidance Congress held at Istanbul Kültür University between 13-15 June 2022.

ABSTRACT

This preliminary study aims to address situations such as high anxiety, stress, inability to focus, and physical burnout experienced by students in the exams made during the transition to a higher education process in the educational system. It also aims to contribute to the development of students' academic and social-emotional skills, in other words emotional literacy through mindfulness training. For this reason, the effects of neuroscience-based mindfulness training on pupils in the eleventh grade's levels of stress, anxiety, and positive and negative emotions were explored. Seven voluntarily recruited high school juniors in the 11th grade made up the study's sample. The study was conducted over the course of 4 weeks and 6 sessions with the children after school. Data gathering tools are congruent with mixed method research design. Data collection instruments of Positive and Negative Emotion Scale (PANAS), Depression, Anxiety, and Stress Scale adapted for high school students (DASS-42) and Mindfulness Scale for Adolescents were employed as pre and posttest measurements. The study also conducted pre- and post-interview forms to gather opinions from the students regarding the study. The results of the study revealed a significant difference between the pre-test and post-test scores of being non-judgmental subscale of the Adolescent Mindfulness Scale (p=.023 <.05) and the positive emotion subscale of the Positive and Negative Affect Schedule (p=.018 <.05). However, there was no significant difference found in terms of stress and anxiety scores, as measured by the Depression, Anxiety, and Stress Scale (DASS-42). During the interviews with the students, it was reported that they were able to identify their emotions and had started to effectively manage stress. This finding supports the results regarding emotional regulation. Based on these findings, it is suggested that implementing mindfulness activities and integrating them into existing school programs could be beneficial. Such programs would assist students in managing their stress, regulating their emotions, and ultimately contribute to their overall learning experience, which is supposed to contribute to their academic and emotional literacy.

Key words: Mindfulness, Neuroscience, Stress, Anxiety, Positive And Negative Emotions

INTRODUCTION

An individual's awareness of the environment and self brings him/her to a conscious level. *The Oxford dictionary* (2014) defines mindfulness as "a mental state that occurs when a person calmly accepts his feelings, thoughts, and bodily sensations." Mindfulness includes special practices used to ensure one's concentration, focus, interest, and motivation. (Broderick & Jennings, 2012). It can be understood as consisting of three interconnected mental skills and tendencies: (a) directing attention to the present moment, (b) perceiving the present moment with calmness, clarity, and accuracy, and (c) experiencing each moment without being influenced by mental reactions or judgments (Young, 2011). While mindfulness aims to direct and maintain attention to the present moment, its goal is not only to be present in the 'moment' but also to regulate 'how' attention is paid (Wolf & Serpa, 2015). In short, it is the intentional attention to the present moment with an attitude of openness, acceptance, non-judgment, the ability to observe an external experience such as sound, without being judgmental rather than acting on a situation or having deep thoughts (Hick, 2009).

Humans are described as fundamentally emotional and social beings, and the crucial role emotions play in their learning process are emphasized; however, traditional educational paradigms often overlook the influence of emotions on learning, treating it as a separate entity from our physical, mental, and emotional well-being. Nevertheless, research has shown that learning is deeply interconnected with these aspects of our being. Field research has demonstrated the impact of emotions and stress on the learning process, highlighting that emotions are not only indicators of academic achievement but also overall health (Sirianni, 2004; Davidson et al., 2012; Desbordes et al., 2012; Immordino-Yang & Damasio, 2007). It has also been found that we have

Published by Australian International Academic Centre PTY.LTD.

http://dx.doi.org/10.7575/aiac.ijels.v.11n.4p.332

the capacity to improve our ability to regulate emotions and influence the mind and brain (Urry et al., 2006). Given these findings, it is believed that practices that create a safe and non-threatening space for individuals, such as breathwork, walking meditation, yoga, art, music, dance, and more, can support the brain in relaxing and facilitating the learning process (Goyal et al., 2014). By immersing individuals in these practices, we can help regulate emotions, reduce stress, and create an optimal state for learning.

In recent years, mindfulness has been implemented for children and adolescents with different programs and has become an important component of preventive mental health with programs integrated into school environments. Interventions related to mindfulness stand out as a promising type of intervention for young people (Zoogman et al., 2015) and an increasing amount of research is being conducted on this subject.

The effects of these interventions on physical and psychological health for adults shown in many studies, have also been studied for young people. In a meta-analysis study that compiled studies on young people under the age of 18, Zoogman et al. (2015) stated that the effectiveness of interventions usually performed in non-clinical school-like settings was studied. In this sense, the participation of not only school psychological counselors but also teachers in the process is considered important.

In their thematic analysis study in Ager et al. (2015), they examined the diaries of primary school students and stated that these skills have effects on students' gaining awareness of the body, mind, and feelings/emotions and suggested new studies on showing the effects of mindfulness practices to strengthen students' well-being and learning skills. In another study with minority children, it was found that mindfulness skills were effective in reducing children's levels of depression and anxiety (Liehr & Diaz, 2010).

In addition, in her study examining the relationship between mindfulness and emotion regulation and anxiety levels of adolescents attending high school between the ages of 15-18, Kısmetoğlu (2019) emphasized the importance of these skills by revealing that conscious awareness has a positive relationship with functional emotion regulation and a negative relationship with anxiety.

While mindfulness contributes to the mind-body integrity of children and young people and their relationship with emotions, academic achievement, and mental executive functions, it also influences the state of being connected with oneself and one's surroundings (Ager et al., 2015). The importance of social, emotional, cognitive, and physical development is indisputable, especially to be successful in formal education. In formal education, the exam can be said as one of the factors that force the student. However, exam success depends on reading, comprehension, integrating the ideas presented in the text, and forming new inferences using their prior knowledge (Graesser et al., 1997). For this, a good focus skill is needed for reading comprehension (Smallwood, 2011). In this sense, mindfulness supports reading comprehension by facilitating the student's focus (Arrington et. all, 2014). Reading develops working memory. Working memory is responsible for processing the text read and storing the information by combining it with previous knowledge, allowing new information to be recalled, inferences to be made and new information to be integrated with previous knowledge. The development of working memory plays an important role in reading and comprehension, and studies in the field reveal that mindfulness improves the capacity of reading, comprehension, and working memory (Klingberg, 2010, Jha et al., 2010). However, exam success depends on reading, understanding, integrating the ideas presented in the text, and creating new inferences by using their prior knowledge (Graesser et al., 1997). For this, good focusing skill is needed to understand what you read (Smallwood, 2011). In this sense, mindfulness helps students to focus and understand what they read (Arrington et al., 2014). Working memory with reading, thus, facilitates the processing of the read text and the storage of information by combining it with prior information, which enables the recall of new information, making inferences and integrating new information with prior information. The development of working memory plays an important role in reading and comprehension, and studies in the field reveal that mindfulness improves the capacity of reading, comprehension, and working memory (Klingberg, 2010, Jha et al., 2010). It could be stated that mindfulness practices can enhance students' literacy skills by promoting focus, concentration, and attention. When students are able to cultivate a state of mindfulness, they can better engage with reading materials, comprehend complex texts, and apply critical thinking skills during the reading process.

Neuroscience and Mindfulness

Neuroscience-based mindfulness can be expressed as a new, interdisciplinary practice of mindfulness and neuroscientific research. In an experimental research to test the effects of mindfulness on the brain, changes have been found in different parts of the brain as a result of mindfulness practices. For example, breathing exercises and mindfulness meditators have been found to show significantly greater cortical thickness in the frontal regions of the brain, the medial prefrontal cortex, and the superior frontal cortex (Lazar et al., 2005; Holzel et al., 2011; Farb et al., 2013). Mindfulness helps them better cope with the stresses of life, develop meta-cognitive skills that can help the person with the ability to move away from the center or re-perceive, reduce stress (Greeson, 2009).

According to research by Newberg et al. (2010), mindfulness techniques can improve the brain pathways that support empathy, compassion, and moral judgment. From a different perspective on understanding the world of others, they concluded that it affects neuroplasticity. The importance of neuroplasticity is that it creates a positive perspective, that mindfulness practice is a tool to change our perception of ourselves and others, while the situation that increases neuroplasticity can be expressed as interaction and communication. Because emotion has effects on being an individual and reflecting personality, it is also important in learning (Olson, 2014; Siegel, 2007). Everything that an individual does, feels, thinks, and experiences instantly is the reflection of

neurons by connecting. As Porges (2011) says, by learning about the world of others, it enables an embrace of life and at the same time learning about the self. This process is necessary for the development of the mind's relationship with others. Millions of connections across synapses, dendrites, and neurons are strengthened, remade, or replaced repeatedly. This is basically a continuous process and can make it possible for people to react and perceive the world. It can be said that the process that supports this situation is mindfulness. It can provide positioning by understanding both oneself and others individually.

Mindfulness and Adolescence

Adolescence is a developmental period with an increased risk for internalization and externalization problems (Fairchild et. al., 2011). In addition, increased sensitivity to stress during adolescence can have negative long-term consequences (Lancefield, Raudino, Downs, and Laurens, 2016; Petermann et al., 2006), such as cognitive/memory problems, decreased school performance, and increased risk taking (Rhoades, 2008; Shochat, Cohen-Zion, and Tzischinsky, 2014; Medic, Wille & Hemels, 2017).

Mindfulness has an impact on student concentration and reducing problematic behaviors; also, there is an impact of mindfulness especially on so-called problematic behaviors in schools (Berkovich-Ohana, Glicksohn and Gold-stein, 2012). In his research, Siegel (2007) studied the neurological effect of mindfulness practices in the classroom, and he concluded that students gain skills in managing their attention and regulating their emotions in the classroom and in normal life. During adolescence, some conditions such as distraction, aggression, anxiety, depression, sleep disturbance, being defensive, and learning difficulties can be seen. This condition occurs as a result of the reflection of the limbic system, thalamus, amygdala, norepinephrine, epi-nephrine, and cortisol process in the brain (Siegel 2007). Neuroscience shows that these students unconsciously turn off their ability to think and learn as part of their neurological inclination to protect themselves from learning to perceive themselves as a threat (Anderson & Beauchamp, 2012; Colvert et al., 2008). Mindfulness work allows them to be involved in the learning process and perform better in learning (Flook et. al., 2010; Himelstein, 2013; Mason, Murphy, Jackson, 2019). It can also create a positive and safer environment at school, allowing students to regulate their emotions and develop a sense of confidence in the learning environment (Roeser et. al., 2022).

Success in student learning is possible when students focus on teaching materials in a classroom environment where they feel good about themselves. Teachers manage the disruptive behaviors that occur in the classroom while at the same time trying to balance the various learning needs of children. Rebellious behavior in classrooms increases teachers' emotional distress; this process leads to job dissatisfaction and poor teacher attitudes (Darling-Hammond 2001; Montgomery and Rupp, 2005). Programs that train students skills that encourage positive behaviors to create a non-disruptive classroom can ease the teacher burden and make student learning effective. Mindfulness training involves the development of mindfulness, which is achieved through the deliberate application of sustained and non-judgmental attention to the experience in the present moment (Kabat-Zinn, 2003). Expressed differently, mindfulness keeps the student interested, attentive, and focused; that is, it is the skill that eliminates the unnecessary process of emotional, cognitive or behavioral reactions. According to several studies (Barnert et al., 2013; Bögels et al., 2008; Coholic et al., 2012; Flook et al. 2010, Semple et al. 2010, Schonert-Reichl and Lawlor, 2010), mindfulness training is linked to improved self-regulation, attention control, and decreased psychological stress in teenagers. As a result, it may help students learn more effectively in the classroom.

Moreover, students may find formal education tough and demanding. Training in mindfulness can improve students' literacy skills and contribute to their success in learning, and become more involved members of the school environment. In order to help students be more successful academically, training in mindfulness at all levels of formal education by integrating it with the curriculum may contribute to their learning. Mindful students can potentially reap benefits academically and personally. When students take the central tests for the transition to a higher education process, they frequently face excessive anxiety, tension, inability to focus, and physical burnout. Mindfulness training will help with these situations. In this regard, this preliminary study aims to address issues like high anxiety, stress, inability to focus, and physical burnout experienced by students during exams held during the transition to a higher education process in the educational system. It also aims to contribute to the development of students' academic and social-emotional skills through mindfulness training. This study aims to investigate the impact of neuroscience-based mindfulness training on the levels of mindfulness, stress, anxiety, and positive and negative emotions in 11th grade students. For this purpose, the following sub-problems were formulated:

1. Is there a significant effect of neuroscience-based mindfulness training on positive and negative affect of 11th grade students?
2. Is there a significant effect of neuroscience-based mindfulness training on stress and anxiety levels of 11th grade students?
3. Is there a significant difference in students' levels of mindfulness before and after neuroscience-based mindfulness training?
4. What are the opinions of adolescents about neuroscience-based mindfulness training?

METHOD

In this study, mixed method research design was used in line with the purpose of the research. The mixed method is the combination of qualitative and quantitative research models, research and researcher views, and research design approaches (Merriam, 2013; Creswell and Clark, 2017). Creswell and Clark (2017) define six different patterns in the mixed method, in which qualitative and quantitative techniques are used together. In this study, the "concurrent nested model" was

used, in which the data of qualitative and quantitative techniques were collected at the same time and the interpretation was done together afterwards.

In the quantitative dimension of the study, the quasi-experimental design without control group, namely, one group pretest-posttest design was used. The main purpose of this model is to determine the effect of the investigated variable on the group. In relation to this model, whether the independent variable is effective (the effect of the independent variable on the dependent variable) is tested by significance tests of the difference between the pretest and posttest means (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2008; Kıncal, 2010). To collect data, pre-test and post-test were used in accordance with the model.

In the qualitative dimension of the study, the "case study" method was used. According to Creswell (2007), a case study is an in-depth examination of a limited system, based on large and extensive data sets. The focus of the case study is to try to describe an event as it exists. It is the study of a single unit or a system of structures, making dense descriptions and interpreting them depending on the context (Hancock and Algozzine, 2006). A focus group interview was conducted with the case study group, observations were made during the application process and the written opinions of the students were obtained.

Participants/Study Group

Participants of this study were determined through purposeful sampling. In this form of sampling, the researcher prefers a sample that is close to him and easy to access. Working on easily accessible, familiar samples was preferred to provide speed and practicality to the research. In qualitative research, cost and accessibility are factors to be considered in the sample decision (Yıldırım & Şimşek, 2008, p.113). Considering all these situations, a public high school affiliated to the Ministry of National Education was preferred and 7 students who attended the 11th grade at the high school level participated voluntarily in the study. The reason why this group is preferred is that the participants are placed in this high school with similar central exam scores and at the same time, these students are preparing for the university entrance exam. After obtaining the necessary permissions, meetings were held with the school principal and the guidance service, and the announcement of the study was shared with the school principals and the students. Participants' parents were informed and asked to sign the consent form so that they could "participate in the study".

Preliminary data for the study group was collected through the semi-structured interview form before the study started. This form was used to define the working group before the program and to determine its characteristics. Five questions were asked to the participants to have a deeper understanding of their expectations, interested subjects, and aim of their participation. Based on the group's answers to the questions, they had no familiarity or experience with mindfulness practices and about the functions of the brain. According to data from semi-structured interview form, out of 7 participants, none of them were familiar with the mindfulness activities and only one participated in an activity about the functions of the brain. Main themes derived from answers to first three questions of reasons for their participation, subjects they were interested to learn, and their expectations from the training were listed as follows: Main reason for participation in the training seemed as having concentration problems and stress and exam anxiety; mentioned three times for each. Main subjects they are interested to learn was stress and anxiety (mentioned 3 times), hoping to solve concentration problems and feeling good (2 times). The expectations from the training question revealed similar results; ability to solve anxiety (mentioned 4 times), stress (mentioned 2 times), and concentration problems (mentioned 2 times). Finally, positive expectations of self-understanding and development, learning and problem solving were mentioned 4 times in the interview form before the study.

Study Procedure

The content of the study was developed in accordance with the characteristics of the 11th level students and revised by field experts after feedback from professionals. Before the study, a preliminary interview was held with the administrative and guidance units of the school and the purpose and content of the application were shared. Afterwards, an announcement was prepared containing the purpose and the content of the study and interested students were asked to register with the guidance unit. The meetings were held after the school, and the program took place in the course of 4 weeks, 6 sessions. Data collection instruments were applied before and after the program, their opinions on the program was obtained. The study started in the next session with the meeting with the students, the application of the instruments and the preliminary interview. Afterwards, the topics of brain structure, learning, emotions, mindfulness, staying in the moment, noticing, and managing emotions in the content of the program were shared with the students theoretically and practically. Documentation of their participation was kept from students who attended each session. Thus, it was aimed to ensure student continuity and reliability in data collection regarding the study conducted at the end of the program. At the same time, at the end of each session, students were given homework to improve their practice of mindfulness and had discussion about these assignments at the beginning of the next session.

Prior to the study, with the semi-structured interview form, the study group were asked to define their aim, reason for participation, expectations, and interests about the study. After the study program was completed, semi-structured interview form was utilized along with the verbal reflections from the focus group interview. After all, those data merged for qualitative analysis to reflect the opinions and experiences about the study.

Data Collection Instruments

Adolescent and adult mindfulness scale (AAMS)

Originally developed by Droutmana et al. (2018) and Sariçam and Çelik (2018) adapted the Adolescent and Adult

Mindfulness Scale (AAMS) to Turkish. The original and the adapted scale has 19 items with four dimensions, which are named as Attention and Awareness, Being Non-Reactive, Being Self-Accepting and Being Non-Judgmental. For the whole scale, Cronbach alpha internal consistency coefficient was reported as.84 and test-re- test reliability was found.64 for the Turkish version. Cronbach alpha values for the subscales was found α=.79 for attention and awareness, α=.93 for being non-reactive, α=.70 for being self-accepting and α=.67 for being non-judgmental. In this study mindfulness scores of participants were calculated for both in total scores and for each subscale.

Positive and negative affect schedule (PANAS)

The scale was originally developed by Watson et al. (1998) and translated to Turkish by Gençöz (2000). It has 20 items to measure positive and negative affect, 10 items for each. For the Turkish version of PANAS, Cronbach alpha internal consistency coefficient was found.83 for positive and.86 for negative affect; and test-re-test reliability coefficients was reported as.40 for positive and.54 for negative affect. Turkish version of PANAS was used as pre and post measurements to test the changes in participants' positive and negative emotions after the neuroscience-based mindfulness program.

The depression, anxiety and stress scale (DASS-42)

DASS-42 was used to measure the stress and anxiety levels of participants before and after the implementation of neuroscience-based mindfulness program. It was originally developed by Lovibond and Lovibond (1995) and was adapted for Turkish lycee students by Akkuş-Çutuk and Kaya (2018). Among the 3 subscales of depression, anxiety and stress, in this study only stress and anxiety subscales, either of which has 14 items, were used as pre and posttest. Cronbach alpha coefficients was found.84 for anxiety subscale and.86 for stress subscale.

Semi-structured interview form

Two different semi-structured descriptive interview forms prepared by the researchers were applied to the participants. Preliminary data for the study group were collected through a semi-structured interview form before starting the study. The aim is to provide participants with a better understanding of their expectations, the topics they are interested in and the purpose of participation, and to define the group and determine its characteristics. Six questions were asked to the participants to have a deeper understanding of their expectations, interested subjects, and aim of their participation. The questions of the interview form were presented below:

1. Why did you volunteer to participate in this program?
2. Which topics in the program attracted your attention the most?
3. What are your expectations from this program and how do you think it will contribute to you?
4. Have you participated in a training such as mindfulness, breathing exercises, yoga, meditation etc. before? If yes, could you share with us?
5. Do you have any knowledge about the functioning and structure of the brain? Have you attended any trainings or seminars on this subject?
6. If you need to describe your learning or mental process (easy to learn, quickly bored, able/unable to control your attention/concentration, high/low perception and motivation to learn, etc.), how would you describe yourself?

The second semi-structured interview form was prepared for the purpose of obtaining opinions from the students about the study at the end of the research. The interview form consisting of 7 questions, was presented as follows:

1. Did you enjoy participating in this program as a volunteer for 4 weeks? If yes, could you share your thoughts and feelings?
2. Did you achieve the goals you had in your mind before participating in this program? If yes, how?
3. What are the topics and activities that contributed to you in this program? Why?
4. Could you share your thoughts and feelings during this program?
5. Did you find the information about mindfulness and brain/learning useful? If yes, how?
6. Did you experience differences in your own emotions, thoughts, learning, motivation, stress, sleep, etc. after this program? If yes, how?
7. What are your opinions and suggestions regarding the implementation of this program?

Data Analysis

The analyses of data were carried out with SPSS 20 package program. The Wilcoxon Signed Ranks Test was used to measure the effects of neuroscience-based mindfulness training on different variables.

In order to analyze qualitative data obtained by semi-structured interview after the study and the focus group, first these inquiries were transcribed and transformed into a conceptual content. The data obtained from the semi-structured interviews were first combined into two categories by experts. One of these categories named as feelings and thoughts, and the other one was named as the benefits obtained from training. Experts separately thematized the questions representing this category and expressed their opinions as concepts under these themes. A conceptual content was created by comparing the analyzes made by both experts. In this sense, an effort was made to ensure consistency among the coders. Moreover, since research ethics require the anonymity of the names of the students participating in the research (Glesne, 2012, pp. 233-237; Merriam, 2013: 222), each participant was assigned a code.

FINDINGS

In this study, the effect of neuroscience-based mindfulness training on the positive and negative affect, stress, anxiety

and mindfulness levels of 11th grade adolescents was examined. For this purpose, Wilcoxon Signed-Rank Test was used to examine the effect of neuroscience-based mindfulness training on positive and negative mood on adolescents, which is the first sub-problem of the study. The findings of this problem are given in Table 1.

According to the findings of the first sub-problem, a significant difference was found between the pretest (*M*=25, *SD*=8.32) and posttest (*M*=33, *SD*=5.62) scores of the Positive and Negative Affect Schedule; the results showed a significant increase in the positive affect dimension after the training (*Z* (-2.366), *p* =.018).

In the negative affect sub-dimension, there was no significant difference between the pretest (*M*=24.85, *SD*=6.14) and the post-test (*M*=21.57, *SD*=6.70) scores of the instrument (*Z* (-1.442), *p* =.149).

For the second sub-problem of the research, in order to examine the effect of neuroscience-based mindfulness training on the stress and anxiety levels of adolescents, Wilcoxon Signed-Rank Test was used. The findings of this problem are given in Table 2.

According to Table 2, when the stress and anxiety scores of the students before and after the training were examined, there was no significant difference between the pretest and posttest scores of stress (*Z* (-.423), *p* =.672) and anxiety (*Z* (-.593), *p* =.553) scores as measured by DASS-42 sub-dimensions.

The third sub-problem of the study was to examine whether there was a difference in the mindfulness levels of the students before and after the neuroscience-based mindfulness training. The findings of the Wilcoxon Signed-Rank Test analysis are given in Table 3.

Whether the mindfulness levels of the students differed before and after the training was determined by pretest-posttest analysis of the Adolescent Mindfulness Scale and its sub-dimensions' scores. Accordingly, a significant difference was found between the pretest (*M*=6, *SD*=1.73) and posttest (*M*=7.42, *SD*=1.81) scores of the being non-judgmental sub-dimension of the scale (*Z* (-2.271), *p* =.023).

There was no significant difference found between pretest and posttest scores of Adolescent Mindfulness Scale total scores (*Z* (-.677), *p* =.498) and other sub-dimension scores of attention and awareness (Z (-.763), p =.455), being non-reactive (*Z* (-1.342), *p* =.180) and being self-accepting (*Z* (-1.169), *p* =.242).

Another sub-problem of the study, which includes in the qualitative dimension, was examined in accordance with the semi-structured interview form and opinions were discussed in the focus group after the study. Those data were merged and evaluated together. After thematic analysis and forming the conceptual content, the results derived from the opinions and experiences of participants about the neuroscience-based mindfulness training, presented in two themes are given below in Table 4. The concepts under general themes and their frequencies and percentages were also presented.

Qualitative findings of the study showed that participants have gains consistent with educational objectives of the training and their personal expectations. Qualitative findings supported quantitative findings of the study with respect to increased positive emotions and being non-judgmental.

DISCUSSION

In this study, the effects of a 6-session neuroscience-based mindfulness training program was tested on stress and anxiety, positive and negative affect and mindfulness levels of adolescents. The first two sub-problems of the study examined the effect of training on adolescents' positive and negative mood and state of stress and anxiety levels. According to the findings of the sub-problem, a significant difference was found between the pretest (*M*=25, *SD*=8.32) and posttest (*M*=33, *SD*=5.62) scores in the positive emotion sub-dimension of the Positive and Negative Affect Scores in line with the pre and posttest scores utilized before and after the training (*Z* (-2.366), *p* =.018). Emotions can simply be expressed as biologically based responses that regulate the way we respond to situations we encounter (Garnefski et al., 2002). Being aware of emotions at a given moment and managing emotions is important for the individual. In this sense, considering that adolescence is a period in which emotions are complex, we can say that the individual's recognition of his emotions is the first step. One goal of the mindfulness program is to create emotion awareness, and this is expressed in the interviews with students; as seen in the examples: "It *made me aware of my feelings"; "I became aware of my feelings and thoughts"; "I live my emotions better, I listen to my body and my thoughts more."* In addition, when the literature was examined, the participants had an increase in mindfulness and subjective well-being levels, and a decrease in stress symptoms (Carmody and Baer, 2008; Matousek, Dobkin and Pruessner, 2009; Falkenström, 2010); found an increase in meta-cognitive awareness and a decrease in the recurrence of depression (Teasdale et. al., 2002). In her study examining the relationship between mindfulness and

Table 1. Wilcoxon signed ranks test results by positive and negative affect variable

	M	***SD***	**N**	***Z* score**	***p* (2-tailed Sig.)**
Positive Affect Pretest	25	8.32	7		
Positive Affect Posttest	33	5.62	7		
Negative Affect Pretest	24.85	6.14	7		
Negative Affect Posttest	21.57	6.70	7		
Positive Affect Posttest-Pretest			7	-2,366	0.018*
Negative Affect Posttest-Pretest			7	-1.442	0.149

*$p<.05$

Table 2. Wilcoxon signed ranks test results by stress and anxiety variable (DASS-42)

	N	*Z* score	*p* (2-tailed Sig.)
DASS Stress Posttest-Pretest	7	-0.423	0.672
DASS Anxiety Posttest-Pretest	7	-0.593	0.553

Table 3. Wilcoxon signed ranks test results by mindfulness scale scores

	N	*Z* score	*p* (2-tailed Sig.)
Mindfulness Total Posttest-Pretest	7	-0.677	0.498
Attention and Awareness Posttest-Pretest	7	-0.763	0.445
Being Non-Reactive Posttest-Pretest	7	-1.342	0.180
Being Self-Accepting Posttest-Pretest	7	-1.169	0.242
Non-Judgmental Outlook Posttest-Pretest	7	-2.271	0.023*

*p<.05

emotion regulation and anxiety levels in adolescents attending high school between the ages of 15-18, Kısmetoğlu (2019) emphasized the importance of these skills by revealing that mindfulness has a positive relationship with functional emotion regulation and a negative relationship with anxiety. Similar findings supported the value of emotion regulation skills and increased positive emotions, in both quantitative and qualitative parts of this study, mentioning their positive emotional state like feeling happier. In other words, it can be stated that those kinds of interventions can be utilized for students as part of their programs to contribute to their emotional literacy. That kind of intervention also could be supportive for being healthy and well-functioning adults.

In the third sub-problem of the study, the question "Is there a difference in the mindfulness levels of students before and after the training?" was tested. A significant difference was found between the pretest (M=6, SD=1.73) and posttest (M=7.42, SD=1.81) scores of the participants in the non-judgmental sub-dimension (Z (-2.271), p =.023) of mindfulness scale scores. Studies on the effect of mindfulness training on the individuals also supported this finding (Lykins and Baer, 2009; Özyeşil, 2011; Siegel, Germer and Olendzki, 2009). In interviews with students, I "*learned to calm down"; "My self-confidence increased"; "my self-esteem increased"; "I*

Table 4. Opinions of participants about neuroscience-based mindfulness program

Theme 1: Feelings and thoughts about the training		
The reasons they like the training program	***f***	***%***
To be considered, and feel valued and equal	3	43
Learning to control stress	1	14
Feeling happy	1	14
Feelings and thoughts experienced during the program		
Know more about my brain system/Focus more on my body and thoughts/Can concentrate	3	43
Have noticed my feelings and thoughts/I have a better capability to regulate my emotions	2	29
Feeling learned, being non-judgmental/Realized can't learn with stress	2	29
Opinions and suggestions on the implementation of the program		
Should have been longer/less in terms of time	2	29
Should be given to others	4	57
Theme 2: Benefits obtained from the training		
Achieving the intended goals		
"I have learned to calm down"	1	14
Have learned to be more comfortable in exams, value my thoughts much more and don't judge them. Accept the situations as it is.	1	14
The most contributing topics and activities		
Calming myself/improving the senses of the peripheral nervous system/breathing exercise, managing my mind	3	43
To be able to organize our perceptions/to examine them thoroughly/to acknowledge the value of everything	3	43
The topic you mention about being non-judgmental	1	14
How knowledge about mindfulness and brain-learning works		
Learned to calm down/Calmer in exams	2	29
Self-confidence/self-esteem increased/started to value own thoughts more	2	29
Managed my sleep/Started my day happier in the morning	2	29
Don't criticize myself	1	14
Perceived changes in participants		
Taking different perspectives/to be mindful in actions and eating/breathing/less stress/feeling happy/calming/improved attention/sleep	4	57
Feeling loved, improved self-confidence/self-esteem/relaxation/being positive/non-judgmental/exam focused	3	43

started the day happier in the morning"; "I'm calmer in exams"; "I began to value my own thoughts more"; with the statements *"I do not criticize myself"*, they expressed the positive effect of neuroscience-based mindfulness training. Being non-judgemental is one of the core elements in mindfulness practices, which contributes the mental wellbeing of the individuals as we think mindfulness as a life skill. In addition, neuroscience describes the continuous configuration of an individual's neuron structures, and therefore the mind is constantly active. Given the complexity of emotions in adolescents, emotions are subject to momentary changes between the present, the past, and the future; one of the factors that can bring this into balance is mindfulness. Because the individual is paying attention to the present moment (Barnes et. al, 2001; Bortolla et. al., 2022), and assuming that the mind can be distracted at any moment, mindfulness can bring the mind back into what to focus and present moment (Borkovec et. al., 2002; Siegel, 2007; Williams and Penmann, 2011). In their research, studies on the effect of mindfulness training on the individuals support those findings (Lykins and Baer, 2009; Özyeşil, 2011; Siegel, Germer and Olendzki, 2009).

According to the study, total mindfulness scores and three subdimensions of the mindfulness scale did not differ before and after the training. Similarly, stress and anxiety points of participants did not differ between pre and posttests. Mindfulness can be stated as a skill that we can teach and learn, but also it can be a trait. A relatively short program of neuroscience-based mindfulness could not be enough for internalizing the learned practices. The changes in the anxiety and stress could not be reflected in results. Similarly, the opinions of the students about the training reflected the request of the longer interventions.

CONCLUSION AND RECOMMENDATIONS

Considering the developmental characteristics of adolescents, emotions have an important role in their learning. Formal education can be challenging and stressful for all students. Mindfulness training can help students become more successful learners and more engaged members of an education community. Integrating mindfulness into the curriculum at all levels of formal education can contribute to students' academic and personal development and learning.

The challenges and stress experienced during formal education can impact students' ability to learn effectively. Mindfulness training offers a valuable solution to support students in becoming successful learners and engaged members of the education community. By integrating mindfulness into the curriculum at all levels of formal education, we can positively contribute to not only students' academic development, but also social emotional skills, which seems to be important for developing emotional literacy. Self-awareness, emotional control, and resilience are critical abilities for handling the pressures of education and life outside of the classroom and can be developed by students through mindfulness activities. Additionally, introducing mindfulness into the curriculum fosters a positive learning environment that supports both mental and general well-being. It enables pupils to become more focused, concentrated, and attentive, improving their capacity to engage with the subject matter and successfully assimilate information.

In conclusion, understanding how emotions, the mind, and learning are interconnected is crucial for creating effective educational strategies. In this regard, including mindfulness into the curriculum can have a profound effect on students' academic success and personal development; in terms of equipping students with the skills to overcome obstacles, deal with stressful situations, and master in their learning. More comprehensive and controlled studies with larger groups from different grades, research design with control groups and increasing the number of sessions are recommended.

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