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ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»
ЧФ «Халық»

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В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz.

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

С уважением,
Благотворительный Фонд «Халык»!

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UNDERSTANDING MATH ANXIETY AND ITS IMPACT ON MATH EDUCATION STUDENTS' CAREERS

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Abstract. With an emphasis on its possible effects on future careers as mathematics instructors, the study explores the widespread problem of math anxiety among students pursuing mathematics teaching. The study aims to identify the multifaceted components of math anxiety, including its cognitive and affective dimensions, and explores various contributing factors such as genetic predispositions, gender differences, and early educational experiences. The research scrutinizes the impact of elementary school mathematics experiences, teacher practices, and parental involvement on the development of math anxiety among aspiring mathematics educators. It delves into the beliefs and attitudes students hold towards mathematics, unveiling the intricate connections between self-perception, feelings of inadequacy, and a lack of confidence in mathematical skills. The study extends its focus to parental math anxiety and its potential adverse effects on children's learning experiences. It aims to shed light on the complex interplay between parental math anxiety, assistance with math homework, and its impact on children's math learning. Understanding the existence of math anxiety among students pursuing mathematics education and its implications for future careers as mathematics teachers is crucial. The research aims to contribute valuable insights for educational policymakers, curriculum developers, and educators to design interventions that alleviate math anxiety and foster a positive learning environment for aspiring mathematics teachers.

Keywords: mathematics education, math anxiety, future mathematics teachers

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МАТЕМАТИКАЛЫҚ ҮРЕЙ ЖӘНЕ ОНЫҢ БОЛАШАҚ МАТЕМАТИКА ПӘНІ МҰҒАЛІМДЕРІНІҢ МАНСАБЫНА ӘСЕРІ

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Аннотация. Зерттеуде математикалық білім алатын студенттер арасында жиі кездесетін математикалық мазасыздық мәселесі айтылады, оның математика мұғалімдерінің болашақ мансабына тигізетін әсеріне назар аударылады. Зерттеу математикалық мазасыздықтың көп қырлы компоненттерін, оның когнитивті және аффективті аспектілерін анықтауға бағытталған және генетикалық бейімділік, гендерлік айырмашылықтар мен ерте оқу тәжірибесі сияқты әртүрлі ықпал етуші факторларды қарастыруымен маңызды. Зерттеуде математикалық тәжірибенің бастауыш сыныптардағы рөлі, жалпы мұғалімдердің тәжірибесі және ата-аналардың сабаққа қатысуының бастауыш математика мұғалімдеріндегі математикалық мазасыздықтың одан әрі дамуына әсері туралы айтылады. Онда студенттердің математикаға деген сенімдері мен көзқарастары қарастырылады, өзін өзі қабылдау, жеткіліксіздік сезімі және математикалық қабілеттерге деген сенімсіздік арасындағы күрделі байланыстар ашылады. Зерттеуде ата-аналардың математикаға қатысты алаңдаушылығына және оның балалардың оқу процесіне ықтимал теріс әсеріне назар аударылады. Зерттеу мақсаты – математикадан үй тапсырмасын шешуге ықпал ету және балалардың математиканы үйренуге деген ықыласын оята отырып, ата-ананың да математикалық мазасыздығын жоюға көмектесу. Математикалық білім алатын студенттер арасында математикалық алаңдаушылықтың бар-жоғын анықтау және оның математика мұғалімдерінің болашақ мансабына әсерін түсіну өте маңызды. Зерттеудің мақсаты да сол — білім беру саясатында оқу бағдарламаларын құрастырушылар мен оқытушыларға математикаға қатысты алаңдаушылықты жеңілдететін және еңбек жолын жаңадан бастаған математика мұғалімдері үшін жағымды оқу ортасын құруға ықпал ететін іс-шараларды әзірлеу үшін құнды ақпарат беру.

Түйін сөздер: математикалық білім, математикалық мазасыздық, болашақ математика мұғалімдері

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МАТЕМАТИЧЕСКАЯ ТРЕВОЖНОСТЬ И ЕЁ ВЛИЯНИЕ НА КАРЬЕРУ БУДУЩИХ УЧИТЕЛЕЙ МАТЕМАТИКИ

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Аннотация. В исследовании рассматривается распространенная проблема математической тревожности среди студентов, получающих математическое образование, с акцентом на ее потенциальное влияние на будущую карьеру учителей математики. Статья направлена на выявление многогранных компонентов математической тревожности, включая ее когнитивные и аффективные аспекты, и исследует различные способствующие факторы, такие как генетическая предрасположенность, гендерные различия и ранний опыт обучения. В исследовании тщательно изучается влияние математического опыта начальной школы, практики учителей и участия родителей на развитие математической тревожности у начинающих преподавателей математики. В нем рассматриваются убеждения и отношение студентов к математике, раскрываются сложные связи между самовосприятием, неуверенностью в математических способностях. В исследовании также акцентируется внимание на тревожности родителей по поводу изучения математики и потенциальное негативное влияние на процесс обучения детей. Его цель – пролить свет на сложную взаимосвязь между родительской математической тревожностью, помощью с домашним заданием по математике и ее влиянием на изучение математики детьми. Понимание существования математической тревожности среди студентов, получающих математическое образование, и ее последствий для будущей карьеры учителей математики имеет решающее значение. Цель исследования – предоставить ценную информацию лицам, определяющим политику в области образования, разработчикам учебных программ и преподавателям для разработки мероприятий, которые снижают беспокойство по поводу математики и способствуют созданию позитивной учебной среды для начинающих учителей математики.

Ключевые слова: математическое образование, математическая тревожность, будущие учителя математики

Introduction

In late 2019, the Organization for Economic Cooperation and Development (OECD) presented the initial findings of the PISA-2018 global survey. This marked a significant milestone for Kazakhstan, as it registered its poorest performance in the history of the country's involvement in PISA. Among the 79 countries and economic regions whose students participated in the assessment, 15-year-olds from Kazakhstan secured the 69th position (OECD, 2023 a). PISA, an abbreviation for the Program for International Student Assessment, is an extensive study crafted to assess the academic achievements of school students. The program was launched in the year 2000 and follows a triennial research cycle, each cycle being focused on one of the core subjects: reading, mathematics, and science.

A mere 2 % of Kazakhstani students reached a level 5 or above in mathematics, while the OECD average stands at 11 % (OECD, 2023 a). Following this setback, the Government of Kazakhstan made it a top priority to enhance the performance of Kazakhstani students in the PISA test. To accomplish this goal, it is crucial for the Government of Kazakhstan to identify the primary causes of these shortcomings.

Information extracted from the PISA underscores a persistent inverse correlation between mathematics anxiety and performance in math, both at the national level and among the various participating countries. In 63 out of the 64 educational systems engaged in the 2012 PISA evaluation, Students who expressed greater levels of math anxiety demonstrated poorer math performance in contrast to their peers who reported lower levels of math anxiety (OECD, 2023 b). When considering the data from the participating nations as a whole, the consequences become quite significant. Specifically, a one-unit rise in a student's PISA math-anxiety index equates to a substantial 29-point drop in their math score, indicating a medium effect size (Cohen's d = 0.32) (OECD, 2023 b).

The exploration of mathematics anxiety has been a notable area of research since the inception of "number anxiety" by Dreger and Aiken in 1957 (Dreger, 1957: 8). Moreover, it has gained growing recognition and interest in recent years. Richardson and Suinn (1972) define mathematics anxiety as a sensation of stress and unease that hampers the handling of numbers and the resolution of mathematical problems in everyday situations as well as academic contexts (Richardson, 1972: 4). Numerous studies have conventionally viewed mathematics anxiety as a unified concept; however, it seems to encompass various separate elements. For example, Wigfield and Meece distinguished two distinct facets of mathematics anxiety among sixth graders and secondary school students (Wigfield,1988: 7), aligning with the cognitive and emotional dimensions earlier identified in test anxiety by Liebert and Morris (Liebert, 1967: 4). The cognitive aspect, referred to as "concern," involves concerns about personal performance and the possible outcomes of not succeeding. Conversely, the emotional aspect, termed "emotional response," includes sensations of unease, stress during tests, and the accompanying physiological responses.

Over the years, numerous studies have identified several factors contributing to math anxiety. Genetics has emerged as a potential factor under examination. Wang et al. (2020) carried out behavioral genetic studies on mathematics anxiety using a group of five hundred fourteen twelve-year-old twin pairs (Wang, 2020: 13). Significantly, there was a strong association between mathematics anxiety and general anxiety, and a reverse relationship with both mathematical problem-solving and reading comprehension. However, general anxiety did not show notable correlations with either academic measure.

The majority of studies carried out in Western nations have consistently demonstrated that, in comparison to males, girls tend to have higher levels of trait math anxiety and more negative attitudes towards mathematics. This trend is evident in various studies, such as those by Szczygieł, in 2020 (Szczygieł, 2020: 32), and Wang et al. in 2020 through meta-analyses (Wang, 2020: 13). Nonetheless, it is essential to consider the cultural, traditional, and educational systems of individual countries. As a result, the claim that females often have more maths anxiety than boys may differ depending on the nation.

According to Barroso's (2021) research, mathematics anxiety frequently develops as a result of early exposure to the subject in elementary school (Barroso, 2021: 35). By the time children entered secondary school, these experiences had frequently damaged their faith in their mathematical aptitude and caused them to shun the subject altogether. Consequently, the elementary mathematics classroom can be viewed as the initial point where mathematics anxiety begins for many students. Kaskens et al. (2020) also identified the elementary mathematics classroom as a source of math anxiety for certain students (Kaskens, 2020: 14). They attributed this anxiety to teachers' limited proficiency in mathematics and their authoritative teaching approach. They also pointed out factors

such as the excessive use of rote calculations, heavy reliance on memorization, and the presentation of unrealistic applications or problems as additional contributors to math anxiety.

Beilock and Maloney (2015) pointed out that there were various factors frequently mentioned by prospective teachers as contributors to their math anxiety (Beilock, 2015: 9). They categorized these factors into two groups: prior mathematical experiences and beliefs about mathematics and self. Among those who experienced math anxiety due to prior mathematical experiences, teachers played a pivotal role. Beilock and Maloney (2015) linked negative encounters with past math instructors to their anxiety about mathematics (Beilock, 2015: 9). It appears that teachers' instructional methods have had an influence on the growth of math anxiety. Common teaching practices that heightened anxiety included an overemphasis on drills and practice, an insistence on obtaining the correct answer through the correct method, administering timed tests, memorization of formulas, and strict rule application. In contrast, there was limited utilization of group work, tangible learning materials, and real-world applications in these instructional settings (Demedts, 2022: 8).

According to Jo Boaler (2014), who is a mathematics education professor at Stanford University, timed tests are identified as the primary factor contributing to math anxiety (Conlon, 2021). Numerous school districts throughout the United States incorporate timed tests as a routine component of their teaching. In my local school district, this practice begins from the first grade, where students are presented with a fifty-question test that they must complete within a three-minute timeframe. The district mandates that these tests are administered once per term, although some teachers opt to give them on a weekly basis

Although classrooms are typically considered the primary setting for children to acquire mathematical skills, it's crucial to acknowledge the significant role parents participate in their child's academic success. As a result, researchers have turned their attention to understanding how parental involvement in homework can positively impact student learning and success (DiStefano, 2020). Effective parental participation in homework includes modeling, reinforcement, and fostering open dialogue to cultivate positive attitudes, knowledge, and behaviors. These components have been linked to youngsters performing better academically. Recent studies, however, show that parents' arithmetic worry may have a negative effect on their kids' math prowess and attitudes. This shows that parents who struggle with arithmetic anxiety and help their kids a lot with homework may be doing more harm than good to their kids' math learning and contributing to their own worry. Maloney, Ramirez, Gunderson, Levine, and Beilock's (2015) study, in particular, revealed that children who actively assist their parents with math homework and who themselves suffer from significant math anxiety both experience a decrease in academic progress and an increase in math anxiety (Maloney, 2015: 9).

In the domain of beliefs about mathematics, individuals experiencing math anxiety often expressed feelings of helplessness, fear, insecurity, inadequacy, and insecurity over their mathematics abilities (Haase, 2019: 35). These emotions were intertwined with their self-perceptions, such as believing they were inherently poor at mathematics and incapable of putting in enough effort to excel in the subject. Many of them also believed that they lacked a comprehension of mathematics and saw it as lacking practical utility. This lack of self-assurance in their mathematical abilities and the presence of math anxiety may be found among students of math education who are aspiring to become future math teachers. Such a pessimistic outlook on math and the prevalence of math anxiety within these students could potentially hinder their academic progress at the university or influence their decisions to pursue alternative career paths.

Hence, the purpose of this paper is to determine whether math anxiety exists

among students pursuing mathematics education. This study seeks to evaluate the presence of math anxiety in these students and investigate the strategies they employ to cope with it. Most importantly, this research paper aims to analyze how math anxiety among students pursuing mathematics education can impact their future careers as mathematics teachers.

Materials and methods

This study employs a quantitative research design utilizing a survey instrument to investigate and identify mathematics anxiety among undergraduate university students majoring in mathematics education. The survey was distributed to all participants, and data were collected using a structured questionnaire.

The study utilizes the Math Anxiety Rating Scale (MARS) because it offers a systematic approach to quantify and comprehend the severity of mathematics anxiety. Suinn and Winston were the original developers of the MARS in 2003 in order to fulfil the need for a standardized instrument for comprehensive measurement of mathematics anxiety (Suinn, 2003: 7). Its primary objective is to assess an individual's level of mathematics anxiety, thereby aiding researchers, educators, and psychologists in gaining a deeper understanding of the emotional and psychological aspects affecting mathematical performance.

Participants

The study's participants consisted of undergraduate university students majoring in mathematics education, typically in their 3rd and 4th years of study. All these students were pursuing a bachelor's degree in mathematics education and were selected from a university in the city of Kyzylorda. The rationale for choosing undergraduate students is grounded in the belief that they have been encountered to a substantial amount of mathematical content during their studies, making them representative of future mathematics teachers. The final sample size comprised 80 participants, selected through a convenience sampling method.

Survey

The survey instrument encompassed three primary sections:

A. Demographic Information: In this section, participants were required to provide demographic details, including age, gender, and academic year. The purpose of this section was to offer a general overview of the participants.

B. Assessment of Math Anxiety: The core of the survey focused on the evaluation of math anxiety. Participants were presented with questions related to mathematics, both in terms of general mathematics anxiety and specific mathematics-related scenarios.

C. Coping Mechanisms: To gain insights into how participants manage math anxiety, this section of the survey featured questions concerning their strategies for coping with math-related stress and their attitudes toward seeking help when experiencing math anxiety.

Data Collection

Data collection occurred over a two-week period. Participants were informed of the study's objectives and gave informed permission earlier to survey participation. The survey was administered electronically, granting participants the flexibility to complete it at their convenience. Anonymity of respondents was assured to encourage candid responses. This study adhered to ethical guidelines, and all participants provided informed consent.

Ethical consideration

The research protocol, including the survey methodology and ethical safeguards, received explicit approval from the university's ethical commission. This approval indicates that the investigation was completed following ethical guidelines and regulations. All participating students were provided with comprehensive information about the survey, its purpose, and the voluntary nature of their involvement. They were explicitly informed of their right to withdraw from the survey at any point without facing consequences. To protect the privacy of the participants, the survey was designed to be completely anonymous. Personal identifiers were not collected, and responses were aggregated to maintain confidentiality. This approach ensures that individual responses cannot be traced back to specific participants.

The research protocol, including the survey methodology and ethical safeguards, received explicit approval from the university's ethical commission. This approval indicates that the study was conducted in accordance with ethical guidelines and regulations. The research protocol, including the survey methodology and ethical safeguards, received explicit approval from the university's ethical commission. This approval indicates that the study was conducted in accordance with ethical guidelines and regulations. The research protocol, including the survey methodology and ethical safeguards, received explicit approval from the university's ethical commission. This approval indicates that the study was conducted in accordance with ethical guidelines and regulations. The research protocol, including the survey methodology and ethical safeguards, received explicit approval from the university's ethical commission. This approval indicates that the study was conducted in accordance with ethical guidelines and regulations.

Results and Discussion

Certain aspects of attitudes toward mathematics appear to be shared among various countries and cultures. Countries exhibit differences not only in actual math performance but also in how much students like mathematics, whether they attribute success in math to innate ability or effort, and the importance they place on math education.

These variations in attitudes and approaches to mathematics could potentially influence the degrees of anxiety related to mathematics, although the exact direction of this influence is not entirely predictable. Because of their academic performance, high achievers may have low mathematics anxiety, or vice versa, high anxiety owing to the strong emphasis on maths and academic accomplishment, which might heighten the fear of failing (Foley, 2017: 7). Another layer of complexity is the fact that pupils in high-achieving nations frequently compare themselves to their accomplished peers rather than those in low-achieving nations (Foley, 2017: 7).

A research by Cipora et al. (2022) examined math anxiety in several countries and discovered that there is a variable and inconsistent relationship between a nation's average math anxiety level among its youngsters and their overall math performance (Cipora, 2022: 21). For instance, children in high-achieving Western European countries like Finland, the Netherlands, Liechtenstein, and Switzerland usually show lower levels of mathematics anxiety than children in top-performing Asian countries like Korea and Japan (Cipora, 2022: 21). Both school and university curricula in Kazakhstan, a country in Central Asia, place significant demands on students; therefore, it is imperative to investigate and analyse mathematics anxiety among Kazakhstani students, particularly among those pursuing a mathematical education. The causes of these differences are unclear and could be linked to factors such as the significant pressure to perform well in exams in Asian countries, or as-yet-undetermined elements of educational systems and curricula.

The survey results revealed that 55 % of the participants reported experiencing math anxiety. The third-grade students exhibited increased mathematics anxiety com-

pared to their fourth-grade counterparts (figure 1). Among those who reported math anxiety, 28.7 % indicated that it began during high school, 23.8 % during elementary school, and 21.3 % mentioned it started during their university years. It is probable that participants in the survey acquired their math anxiety during childhood. Mathematical education researchers assert that children's worry about mathematics tends to increase with age (Wigfield, 1988; Demedts, 2022; Foley, 2017). Although most studies suggest that young children do not often experience severe anxiety related to mathematics, some researchers have found significant levels of anxiety related to mathematics even in young primary school students. This observed rise in math fear is consistent with studies showing that attitudes towards mathematics tend to vary with age, regrettably frequently becoming worse as kids become older (Hart, 2019: 18). Demedts et al. (2022) discovered that while around two-thirds of youngsters aged eleven consider mathematics the subject they like the most, a small number of sixteen-year-olds share the same sentiment.

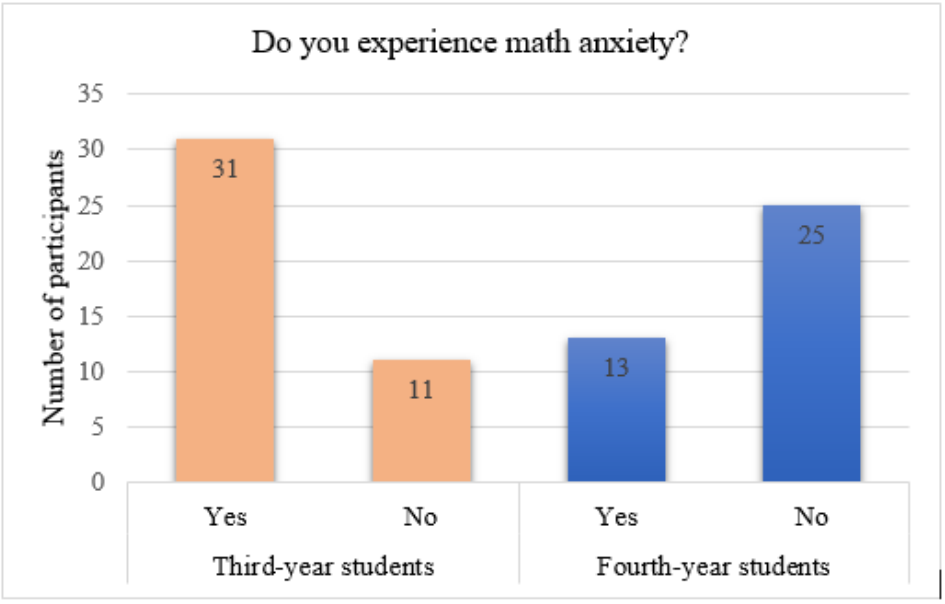

Figure 1 - Math Anxiety Comparison: Third vs. Fourth Year Students

Research on maths anxiety has placed a lot of emphasis on gender. There is little to no difference in actual mathematical accomplishment between the sexes, according to recent research conducted in nations where males and girls have equal access to school (Wang, 2020: 13). Though these differences are not significant, they do show that girls tend to experience higher levels of anxiety about mathematics and to assess themselves less favourably (Wang, 2020: 13). The majority of studies suggests that these gender differences often manifest in adolescence, with elementary school students not showing significant gender differences in maths anxiety (Szczygieł, 2020: 32). Because girls made up 60 % of the study's participants, current research has not been able to find any discernible variations in the rates of math anxiety between males and girls. The majority of female students in bachelor's degree programmes in math teaching made it difficult to get an equal gender distribution for this study.

Recent research aimed to pinpoint the factors behind math anxiety among students pursuing a mathematical education. A notable 27.5 % of the study's participants revealed that their math anxiety stemmed from a lack of self-confidence (figure 2). The

majority of research suggests an inverse correlation between one's self-perception in mathematics and the prevalence of math anxiety (Hart, 2019: 18). Individuals who perceive themselves as lacking proficiency in mathematics are more prone to experiencing anxiety in this subject. This deficiency in self-assurance could be attributed to struggles in math classes, either at various academic levels or at home. In some instances, this lack of confidence resulted from a lack of encouragement from teachers to actively engage with mathematical concepts. Furthermore, it was observed that family members or teachers sometimes unintentionally contributed to this issue. For example, when these individuals conveyed that math was easy, it could create feelings of inadequacy in students who were grappling with mathematical challenges. Conversely, if family members or teachers constantly portrayed math as difficult and openly acknowledged their own inadequacies in the subject, it reinforced the idea that the student was destined to face similar difficulties) (Szczygieł, 2020: 32). The results of this study underscore the detrimental influence that a parent's math anxiety can exert on their children's mathematical learning and their attitudes toward math. Approximately 27.5 % of the participants stated that their math anxiety had its roots in familial factors (figure 2).

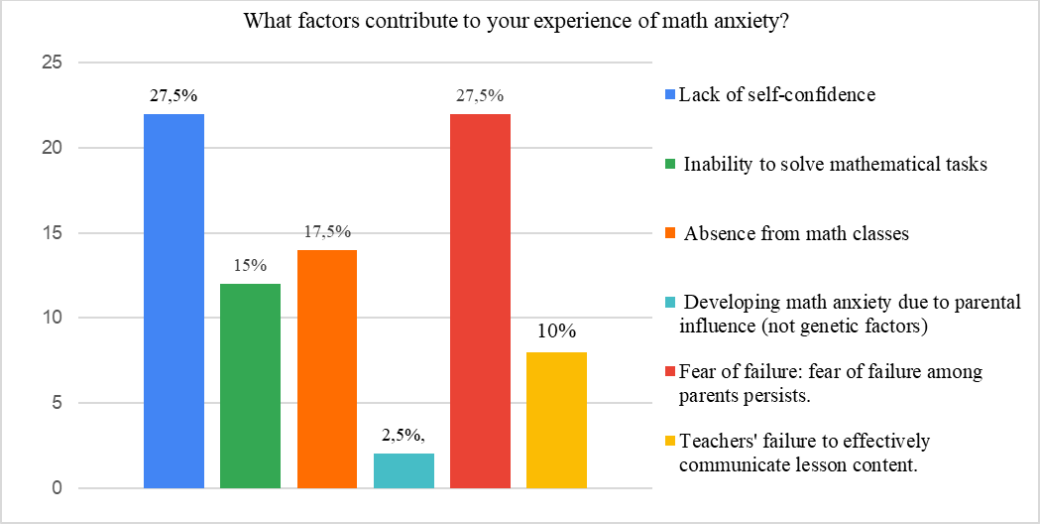

Figure 2 - Causes of math anxiety

Approximately 17.5 % of the participants emphasized that their math anxiety stemmed from difficulties related to missed lessons (figure 2). This issue often arose in university settings where class sizes were large, and professors conducted lessons at a brisk pace, leaving little room for questions or clarifications. Some students found it challenging to comprehend the professor's explanations, as they tended to write mathematical content swiftly on the board without sufficient elaboration (Dreger, 1957: 8). These instructional practices contributed to the students' math anxiety.

Furthermore, students sometimes experienced math anxiety when they observed their peers successfully mastering math concepts while they struggled to do the same (Demedts, 2022: 8). Occasionally, they had enrolled in courses for which they lacked the foundational knowledge or were ill-prepared. In certain cases, the prerequisites for the mathematical proficiency required for their courses were not clearly defined. Therefore, 15 % of participants noted that when they initially enrolled in a course, everything

appeared manageable (figure 2). However, as the course progressed, the assignments demanded a more advanced understanding of mathematics, which they did not possess, leading to heightened math anxiety.

In the survey, respondents were requested to detail their experiences related to math anxiety. Among the responses, students recounted either the symptoms they had experienced due to math anxiety or the factors that had triggered their math anxiety. A total of 37 participants outlined the physical and emotional symptoms they had encountered, while 35 participants expressed their emotions of frustration and bewilderment (figure 3). Additionally, 8 individuals reported feeling highly stressed to the point of disengagement, where they stopped listening.

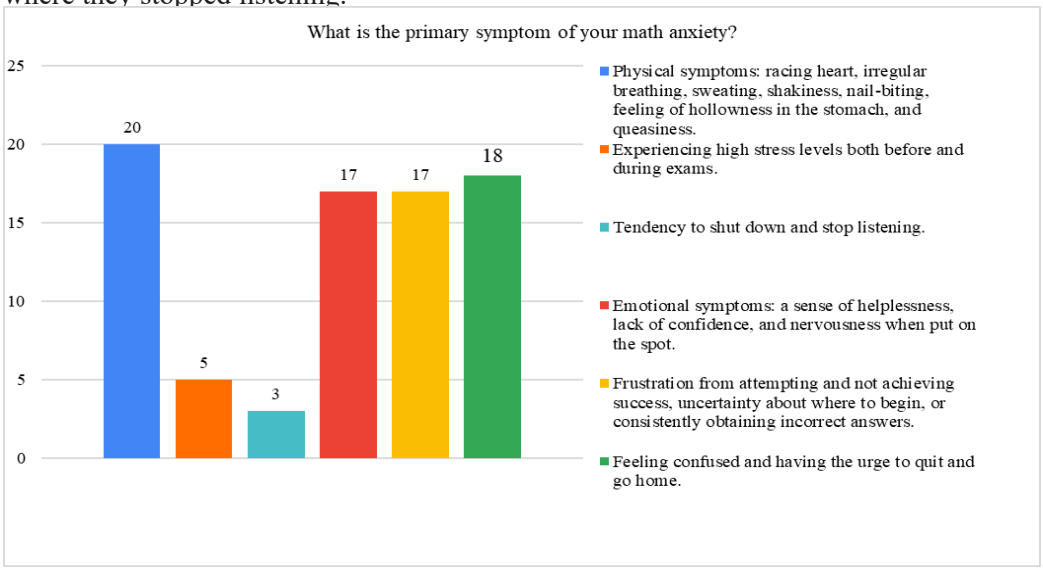

Figure 3 - Symptoms of math anxiety

According to the data presented in figure 4, it is evident that various strategies have been employed by the participants to address their challenges. Students have devised methods to alleviate stress, which includes practices like deep breathing exercises, listening to music, or engaging in self-affirmation to regain composure (22,5 %) (figure 4). Furthermore, 28,7 % of students have concentrated on increasing their self-confidence through strategies like making links to existing knowledge (36,3 %), beginning with easier math problems and working their way up to more difficult ones, and assuring themselves that they can succeed in mathematics (figure 4).

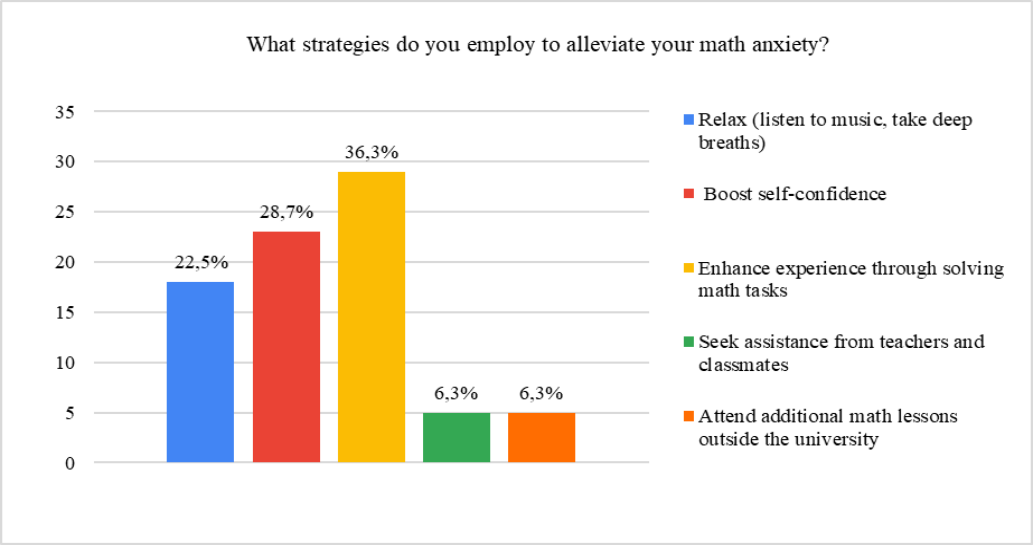

Figure 4 - Personal strategies to alleviate math anxiety

In the survey, participants were queried about the methods they intended to employ as mathematics teachers to mitigate math anxiety. Notably, 35 % of the respondents expressed their intention to incorporate a range of technologies to alleviate this issue (figure 5). Experts in the field of math education emphasize the crucial role of employing diverse resources when studying mathematics. These resources encompass a spectrum of tools such as textbooks, educational videos, math games, manipulatives, and the integration of technology. The utilization of this array of resources is a response to the varied needs of students, aligning with the principles of a constructivist classroom that extends beyond conventional curriculum and textbooks (Kaskens, 2020: 14).

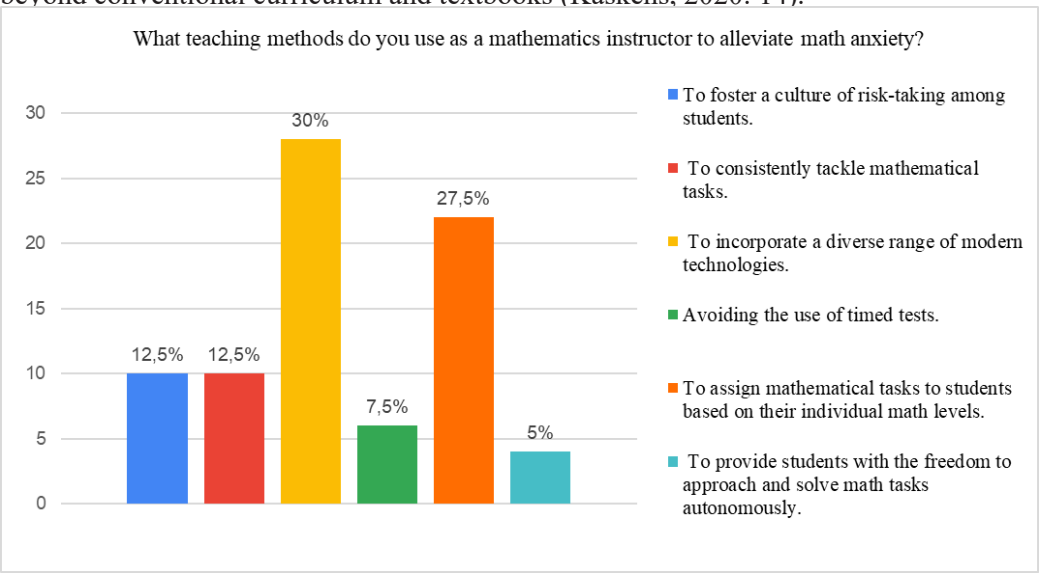

Figure 5 - Teacher strategies to mitigate math anxiety

While 27.5 % of participants emphasized that customizing math tasks to a child's proficiency level could alleviate math anxiety, scholars in the field of math education recognize the importance of actively engaging students in mathematics (figure 5). This

engagement entails tapping into their prior knowledge and fostering reflection by offering explanations and justifications for their solutions. A key learning strategy involves establishing connections between different mathematical topics and relating them to the knowledge acquired in previous courses. Students have discovered that making connections to well-known mathematical concepts helps them to start solving problems when faced with difficult maths questions or problems. This eliminates feelings of helplessness and reinforces the idea that there are several ways to solve maths problems (Conlon, 2021). With a sense of control over their education, this method also fosters kids' creativity and, in the end, lowers math fear.

As depicted in figure 5, 12,5 % of the participants recognized the significance of promoting risk-taking as a crucial element while learning mathematics. They expressed their intent, as future educators, to foster mathematical learning by implementing key components of an interactive learning environment. These components encompass encouraging each student to share their thoughts, fostering the belief that multiple problem-solving methods exist, and allowing mistakes to be opportunities for learning rather than concealing them. These strategies collectively contribute to building students' self-confidence and align with existing research, which underscores the importance of assessing the validity of a solution based on its mathematical coherence. In this instructional context, the teacher engages with students, collaborating with them to formulate their own solutions. This approach empowers students to construct their unique problem-solving approaches, shifting the focus from the teacher as the sole authority (Haase, 2019: 35). In their roles as future educators, they believe that implementing these practices is pivotal in creating an inclusive and innovative learning environment.

The primary objective of the present study is to examine how math anxiety impacts students pursuing mathematics education on their prospective careers as mathematics teachers. A significant portion of the surveyed participants (90 %) express concerns about making errors in mathematics that could have repercussions for their future teaching endeavors. Furthermore, the majority of respondents (65 %) in the survey note experiencing a sense of overwhelm when contemplating the prospect of teaching mathematics in the future, attributing this apprehension to their math anxiety.

Conclusion

1950s, with a notable surge in focus in the past few years. This research paper aims to ascertain the presence of math anxiety among students engaged in mathematics education. The study endeavors to assess the prevalence of math anxiety in these students and explore the coping mechanisms they employ. Crucially, the paper seeks to scrutinize how math anxiety among students pursuing mathematics education may impact their prospective careers as mathematics teachers.

The research findings indicate that a significant majority of participants reported experiencing math anxiety. Notably, third-grade students exhibited a higher degree of math anxiety compared to their fourth-grade counterparts. According to the study, most students blamed their lack of confidence in their mathematical skills, helplessness, dread, uncertainty, and inadequacy for their math anxiety. Parental pressure and missed math lessons were also identified as contributing factors to math anxiety.

Moreover, a substantial portion of survey respondents expressed feeling overwhelmed when contemplating the prospect of teaching mathematics in the future, attributing this apprehension to their math anxiety. This pessimistic outlook on math, coupled with the prevalence of math anxiety, may potentially impede academic progress at the university level or influence decisions to pursue alternative career paths. Consequently,

investigating strategies to alleviate math anxiety, particularly among students pursuing math education, becomes imperative.

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