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Research/Review

Exploring the Role of Music Students' Negative Emotions on AI Readiness and Engagement in Music Learning in Indonesia

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Abstract: This study explores the role of negative emotions—such as anxiety, frustration, and self-doubt—on music students' readiness to adopt artificial intelligence (AI) technologies and their engagement in music learning in Indonesia. Against the backdrop of rapid AI integration in education, the research investigates how these emotions mediate the relationship between AI readiness and student engagement. Using a quantitative approach with structural equation modeling (SEM), data were collected from 500 music students across five Indonesian higher education institutions. The findings reveal that negative emotions significantly influence both AI readiness and engagement levels, highlighting the need for emotional awareness in pedagogical practices. The study contributes to the development of strategies that support students' emotional well-being while fostering their adaptability to AI-driven learning tools, ensuring a holistic and inclusive future for music education.

Keywords: Negative Emotions; AI Readiness; Student Engagement; Music Education; Structural Equation Modeling

1. Introduction

Music education is a complex relationship between technical skills, emotional experience and personal engagement. As music students go through their learning journey, they face a range of emotional challenges, particularly negative emotions in the form of anxiety, frustration and self-doubt. These negative emotions can have a significant impact on their motivation, engagement and learning outcomes holistically [1], [2], [3].

Amidst the rapidly evolving digital landscape, the integration of intelligence into music education is becoming increasingly prevalent. Understanding how students' musical experiences with negative emotions relate to their engagement in learning and their preparedness offers valuable insights for educators and researchers [4], [5].

Negative emotions can cause psychological distress to students, but if channeled appropriately, they can also motivate students' pro-environmental engagement in arts learning [6], [7]. Constructive emotions such as hope and moral commitment can also strengthen students' beliefs that individual or collective efforts are important to support sustainable music learning environments [8].

A key component of this research examines the impact of negative emotions (stress, anxiety and frustration) on the overall learning experience and engagement of music students. These emotions are considered crucial in determining how students approach their studies and interact with learning aids [1], [2], [5], [9], [10], [11], [12].

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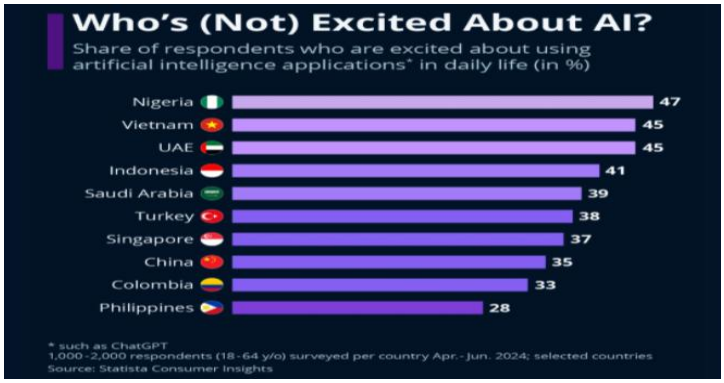
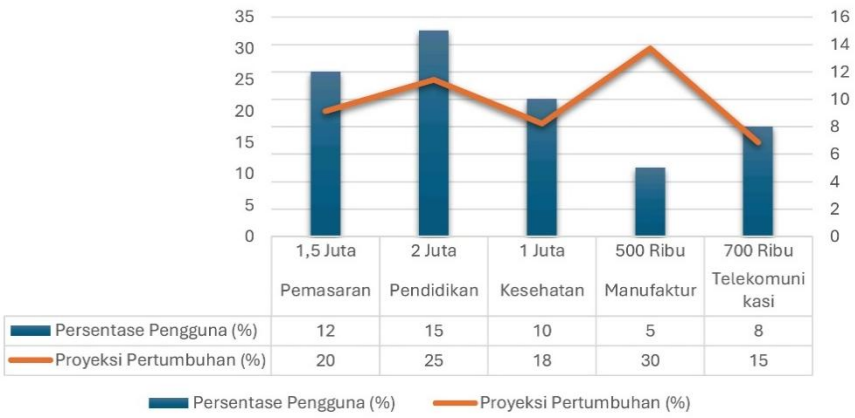


Source: Statista, 2025.

Figure 1. Top 10 AI User Countries in the World

Statista's survey publication (2025), shows Indonesia to be the 4th largest country in the world with the most enthusiastic use of AI. The survey involved between 1,000 and 2,000 respondents in each country surveyed between April-June 2024. This finding reflects a positive trend in many Asian and Middle Eastern countries that are generally open to the development of AI technology compared to European countries that tend to be skeptical about the use of AI.



	1,5 Juta Pemasaran	2 Juta Pendidikan	1 Juta Kesehatan	500 Ribu Manufaktur	700 Ribu Telekomunikasi
Persentase Pengguna (%)	12	15	10	5	8
Proyeksi Pertumbuhan (%)	20	25	18	30	15

Source: Garuda, 2025; Dica, 2025.

Figure 2. Use of AI in Various Sectors in Indonesia

The Garuda survey (2025), shows that the use of AI in the education sector is quite high compared to other centers with projected growth reaching 25% annually. The use of AI in education can improve the quality of learning through language translation and text processing, *learning by asking* and the use of *chatbots* in learning, optimizing the educational process, helping to improve student learning abilities and helping to improve time and cost efficiency [13].

Artificial intelligence (*AI*) readiness assesses students' readiness and openness to adopt AI technologies in their learning process [2], [3], [14]. AI readiness is seen as a crucial factor in how well students can incorporate new technological tools into their academic and musical endeavors [15].

This study explores how students' emotional state and their readiness for AI integration meet their engagement in music learning activities. Engagement is defined by the level of participation, motivation and interaction with traditional technology-enhanced learning methods [14], [16].

The intersection of emotional form, engagement and technology readiness is an important area of investigation in the context of music education. As music students go through their music education experience, they often face a range of negative emotions that can hinder the music learning process [1], [14], [17].

Emotional forms of anxiety and frustration are prevalent in high-stakes environments such as music conservatories, where performance pressure and self-criticism can significantly impact student engagement and overall motivation [18]. Understanding the relationship

between these negative emotions and student engagement is critical as engagement is linked to deeper learning, creativity and a positive educational experience. As artificial intelligence continues to permeate various aspects of education, understanding students' readiness to adopt this technology is increasingly relevant [2], [5], [14].

AI tools have the potential to enhance practice, facilitate personalized learning and provide innovative ways to engage with theory and applications [15], [16], [17]. However students' emotional state and level of engagement play an important role in their willingness to explore and utilize AI technologies [15], [19].

This study is motivated by the need to unravel the complexities of how negative emotions can affect levels of engagement among music students and how this impacts their readiness to incorporate AI into their music practice [4]. By comprehensively explaining causal influences, this study aims to provide music educators with a more in-depth understanding of students' emotional landscape and the factors that enable or hinder students' engagement with music and technology.

Ultimately, this study seeks to foster an educational environment that prioritizes emotional health, equips students with the necessary tools, adapts technology and encourages continuous engagement, ensuring that the future of music education is inclusive and forward-looking [15].

The urgency of this research challenge lies in its potential to shed light on the influence of emotional causality on student engagement and technology readiness in the domain of music education [15], [18]. As music programs increasingly face pressure to integrate advanced technologies, particularly artificial intelligence, understanding the psychological and emotional factors that influence student attitudes and behaviors is important.

Through an exploratory study of causal influences between variables, this research aims and contributes to the improvement of educational outcomes for music students [15]. Insights gained can help educators develop emotional health and foster engagement leading to more effective teaching and learning practices.

Mental health and emotional management are paramount in the demanding field of music education. This study highlights the need for interventions that address negative emotions, thereby promoting better mental health among music education students [15].

The findings of this study have the potential to inform music educators about the importance of emotional awareness in pedagogical practice [15]. Understanding how emotions influence learning and AI readiness may lead to more holistic curriculum development that considers students' emotional and psychological needs alongside their musicianship skills.

As AI devices become more common in music education, offering personalized learning experiences and innovative practices, this study examines students' readiness to embrace AI technology. Understanding the factors that influence this readiness can help music educators implement AI-centered curriculum more effectively and ensure students not only become proficient musicians but also adept at utilizing modern devices.

This study aims to explore the complex and intricate causal influences between music students' negative emotions and their level of readiness to embrace AI technology in music learning and how these factors may affect their engagement in music learning in Indonesia.

The novelty built into this study is that researchers can contribute to the development of music education strategies in Indonesia that not only emotionally support music students, but also increase their readiness to utilize innovative tools for their artistic growth. Thus, music educators can better prepare the next generation of musicians to thrive in a world that is increasingly driven by the dynamization of various forms of AI technological advances.

2. Preliminaries or Related Work or Literature Review

Subsection 1

Music Education

SOR Theory

TAM Theory

Negative Emotions

Artificial Intelligence Readiness

Engagement in Music Learning

Theoretical Framework

Law 20/2003 on the National Education System is the main reference in this study, so that the derivative of the law is the implementation of learning and music education in higher education institutions. The researcher used artificial intelligence readiness as an exogenous variable, music student engagement as an endogenous variable and negative emotions as a mediating variable. To obtain comprehensive and holistic study results, the researcher incorporated the use of TAM and SOR theories into the theoretical framework.

In this study, AI readiness contributes significantly to the academic world in several fields such as scientific research/development, especially music education. This is because AI research plays an important role in various applications, machine learning and natural language processing [20]. AI is easily accessible in many universities and research institutes for the purpose of delivering digital-based teaching programs and experiences. For academia, research is needed to build capacity for new AI efforts as well as worldwide contributions to training programs and knowledge exchange especially in music.

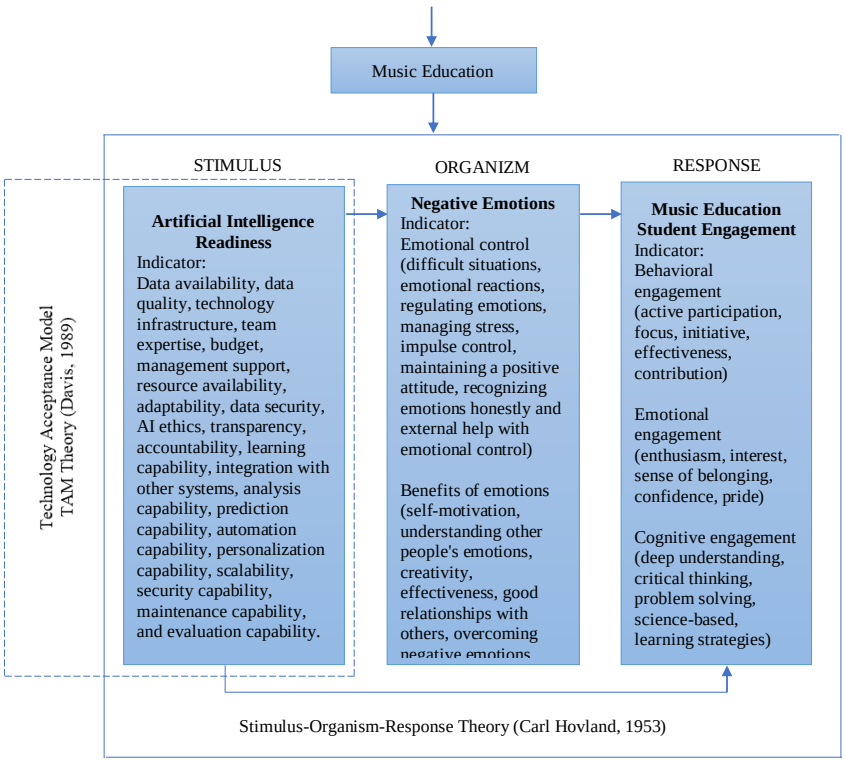


Figure 3. Theoretical Framework

Formulation of Research Hypothesis

The hypothesis development raised in this study is:

H_1 Artificial intelligence readiness has a significant effect on student engagement in music education.

H_2 Artificial intelligence readiness has a significant effect on negative emotions.

H_3 Negative emotions have a significant effect on student engagement in music education.

H_4 Artificial intelligence readiness has a significant effect on student engagement in music education mediated by negative emotions.

3. Proposed Method

Research Objectives

The research objectives raised in this study are to find out and analyze:

- Description of respondents (gender, age, educational institution).
- The influence of artificial intelligence readiness on student engagement in music education.

- The effect of artificial intelligence readiness on negative emotions.
- The influence of negative emotions on student engagement in music education.
- The effect of artificial intelligence readiness on student engagement in music education mediated by negative emotions.

Place and Time of Research

This study was conducted in 4 higher education institutions including Universitas Negeri Jakarta (UNJ), Universitas Negeri Semarang (UNNES), Jakarta Arts Institute (IKJ), Universitas Pelita Harapan (UPH) and Universitas Pendidikan Indonesia (UPI) which have music study programs at the Faculty of Language and Arts, involving 500 students as participants in this study. This study was conducted from June to November 2025.

Object and Scope of Research

The objects of this study are artificial intelligence readiness, negative emotions and art students' involvement in the learning process of music education in five higher education institutions. While the scope of the study is to determine and analyze the impact of negative motivation in mediating the effect of artificial intelligence readiness on student involvement in music education.

Research Methods

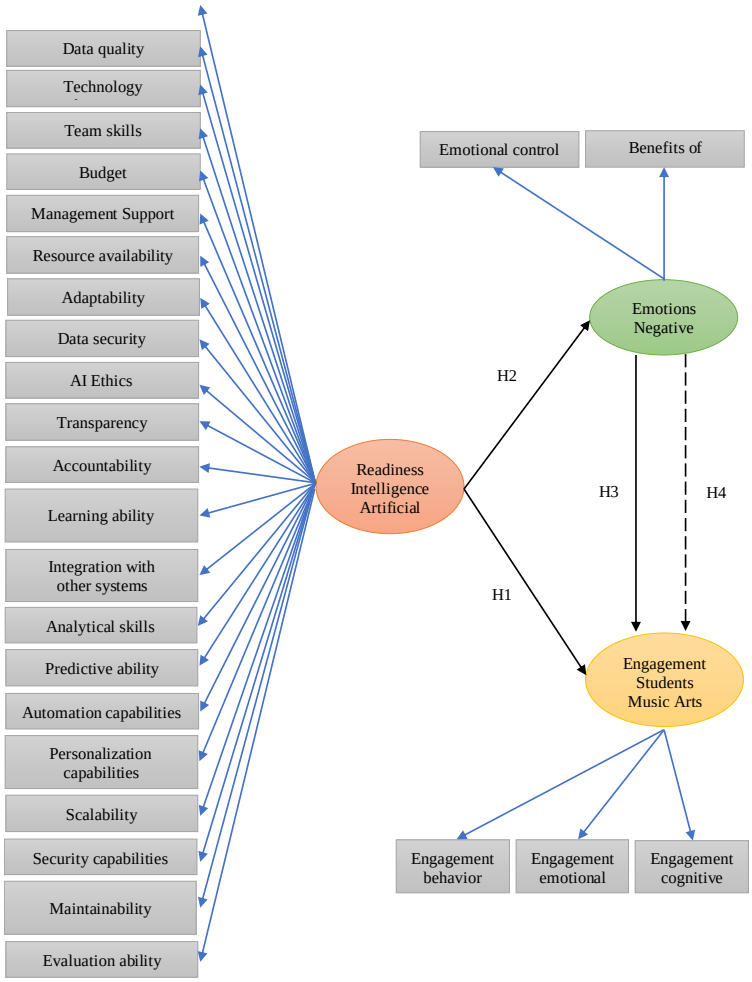


Figure 4. Research Design

This study uses quantitative methods with an explanatory research approach and associative research type which aims to test statistical hypotheses and analyze whether there is a causal influence between exogenous variables on endogenous through mediating variables. The use of *explanatory research* into quantitative research is considered relevant,

because this approach can test the hypothesis framework that is built while testing the models of the TAM and SOR theories more accurately and comprehensively. In addition, the use of *associative research* is used to identify patterns of relationships between research variables.

Population and Sampling

Population as a generalized scope is divided into subjects and objects that have certain qualities and characteristics that researchers build in order to analyze and draw conclusions [21]. The intended population is all students of the music education program who are actively pursuing music education at all higher education institutions in Indonesia. Meanwhile, the sample is part of the number and characteristics of a population. The sample determined can be reflected because the conclusions built on the sample will be used in describing the population [22].

Based on the ability of researchers in terms of processing time and costs incurred in carrying out this study, the sample technique used in the study used purposive sampling with a non-probability sampling method using certain characteristics that researchers determined at the beginning of the study including:

- She is an active student in music education study programs at higher education institutions in Universitas Negeri Jakarta (UNJ), Universitas Negeri Semarang (UNNES), Institut Kesenian Jakarta (IKJ), Universitas Pelita Harapan (UPH) and Universitas Pendidikan Indonesia (UPI).
- Have utilized artificial intelligence in music education learning in the past year.
- Have experienced negative emotions during the music education learning process in college.

Referring to the recommendations of Hair *et al* [23], the sample size is based on the number of indicators used and multiplied by five. The number of indicators is 53 (22 indicators on the artificial intelligence readiness variable; 16 indicators on the negative emotions variable; and 15 indicators on the music education student engagement variable) and multiplied by 5, the sample size in the research framework is at least 265 respondents and still refers to the characteristics used in sampling. Thus, to ensure a stable maximum likehood estimation or robust solution, Hair *et al* [23] and Cooper & Schindler [24] recommend an appropriate sample size between 100-500 samples, so in this study the researcher used a sample of 500 students as participants in this study.

Data Type and Source

This type of primary data is in the form of data and information that researchers obtain directly in the field using a closed questionnaire instrument with answer options that have been provided and using a five Likert scale (interval). There are four reasons researchers use Likert scales with internal five, first because researchers provide a sufficient range of answers for respondents to answer the questionnaire [25]. Second, this scale is effectively understood and filled by respondents [26].

Furthermore, third because visually using a five interval scale is more attractive [21]. Fourth, an interval scale of five is sufficient to see the consistency of the distribution of answers if the number of respondents exceeds 100 respondents, an interval of seven is then more advisable if the number of respondents is less than that [27]. The use of intervals 4,5,6,7,10 or 11 will still provide the same quality results for the same research objectives [28].

While the type of secondary data is in the form of data and information that researchers get through a review of previous research results in the form of scopus indexed international research journals, research articles and theories obtained from relevant books.

Data Collection Technique

The researcher used a questionnaire instrument with a set of instruments containing question items and submitted to music education students at educational institutions at Universitas Negeri Jakarta (UNJ), Universitas Negeri Semarang (UNNES), Institut Kesenian Jakarta (IKJ), Universitas Pelita Harapan (UPH) and Universitas Pendidikan Indonesia (UPI). The items of this instrument were modified and adapted to the issue of using artificial intelligence readiness in music education programs in Indonesia.

The type of research questionnaire uses a closed system, namely the questionnaire submitted has available answers, the respondent simply chooses the answer. The variable measurement scale refers to the Likert scale, which is an interval scale that is able to determine

the strength level of the respondent's level of agreement or disagreement with the statement submitted [26]. This questionnaire instrument will be tested first through validity and reliability tests on 35 initial participants (students of the music arts program at the State University of Jakarta) before the main survey is conducted. This is to convince researchers that the instrument used is feasible to be disseminated to participants at large.

Data testing of questionnaire instruments using two data validity tests includes:

- Data validity test

The data is considered valid if the statements on the questionnaire items can reveal something that is measured through the questionnaire. The various statement items in the questionnaire were tested for related factors. This test aims to make researchers know how carefully the instrument or test performs its measurement function. The measuring instrument is considered valid if this instrument is able to measure what should be measured or can produce the size expected by the researcher.

- Data reliability test

Reliability translated from the word *reliability* has the origin of the word *rely* and *ability*. Measurements that have high reliability are *reliable* measurements. Although reliability has various other names such as consistency, trust, stability, reliability, constancy and consistency. However, the main idea in this concept is the extent to which the measurement results can be trusted by researchers.

Data Analysis Technique

The data analysis technique in this study uses *structural equation modeling analysis* or *SEM* by utilizing the help of *AMOS version 30 for windows statistical software*. *SEM* as a statistical technique used to design and test statistical models in the form of causality models [22]. *SEM* is a structural equation model that is general, linear and very *cross-sectional*.

The use of SEM in the context of this study is also used to test the TAM and SOR theories by analyzing the relationship between latent and observed (manifest) variables directly and indirectly (mediation). The use of the bootstrapping method in SEM to test indirect effects is based on the calculation of the Sobel test with assessment criteria using alpha and critical ratio significance.

The examination of this test is intended to measure and analyze the effect of mediation (4th hypothesis). So that information is obtained regarding the ability of determinant factors in influencing the music education student involvement variable. The following are the stages of SEM analysis in this study.

- Drawing research variables into the research design

Create the direction of the relationship and influence between endogenous, exogenous and mediating variables in the form of a research model design.

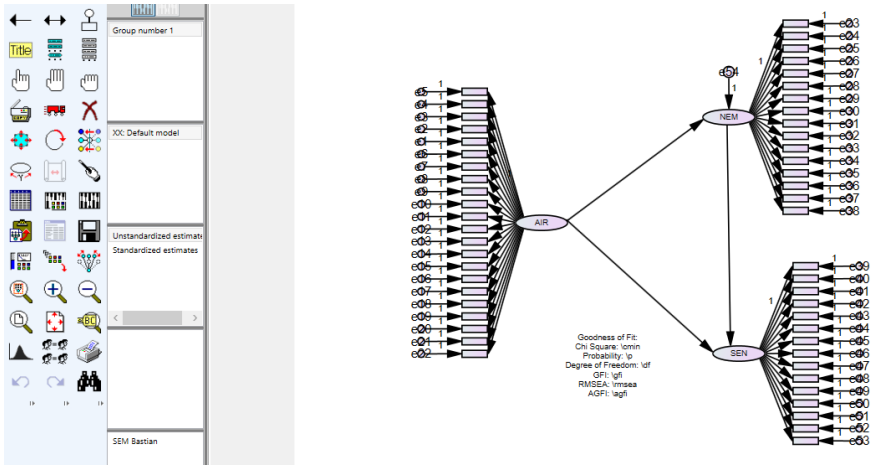


Figure 5. Research Operational Design

- *Confirmation factor analysis* validity testing

The construct test measures whether the indicator can reflect the latent variable. Meet the classical assumption test criteria if the *Critical Ratio* (*CR*) value> 1.96 or *probability* (P) <0.05.

- Testing the validity of *convergent validity*

Test the construct whether it has a high proportion of *variance* or not. Meet the *convergent validity* test criteria, if the *loading factor* or *standardized loading* estimate> 0.5.

- Testing *construct reliability*

Test the reliability and consistency of the data. It meets the *construct reliability* test if the construct *reliability* value is> 0.7 and the *construct reliability* value between 0.6-0.7 is still acceptable under the condition of good model construct validity.

- Validity Testing *Average Extracted* (*AVE*)

Confirmation test by looking at the mean value of *variance extracted* between indicators of each latent variable. Meet this test if AVE> 0.5.

- Testing *discriminant validity*

This test measures how far an indicator can be truly different from other indicators. This criterion test is met if the square root value of *the AVE* is higher than the *correlations* between latent variables. This test is only used among exogenous variables. Using the Fornell-Larcker criterion by comparing the AVE square value with the correlation value between construct variables. If the square root value of the AVE> the correlation value of the construct variable, then the *discriminat validity* test is fulfilled or valid.

- *Residual* normality testing

This test analyzes the level of normality of the data used in this study. Univariate looking at the *CR* value on *Skewness* is expected to be around ± 2.58. However, if there is a value outside this number it can be tolerated if the multivariate value is still around ± 2.58.

- *Mahalanobis distance outlier* testing

This test detects extreme data patterns. You do this by looking at the calculated *mahalanobis distance* value < *chi square distribution table*.

- Testing the *determinant of sample covariance matrix*

This test is used to see if there are symptoms of multicollinearity and singularity in the combination of variables. *Determinants* that are really small indicate symptoms of multicollinearity or singularity. It is expected that the *determinant of sample covariance matrix* can move away from zero and even better if > 1.

- Testing *goodness of fit index* with *full model* test

It is said to have a data *fit* index, if the chi-square value is good. If the other index values are met, the data will be more *fit*. The measured indices and *cut-off values* in this study include *chi-square distribution*; *sig probability* > 0.05; GFI > 0.90; AGFI > 0.90; IFI > 0.90; TLI > 0.90; CFI > 0.90; NFI > 0.90; RMSEA < 0.08; and CMIN/DF < 2.00.

- Research hypothesis testing

It is said that there is a significant effect if the significance value of CR> 1.96 or p value <0.05. The t test is used to test the significance of the effect of exogenous variables (artificial intelligence readiness) on endogenous variables (music education student engagement) mediated by negative emotion variables. This test is conducted to analyze whether the exogenous variable partially has a significant effect on the endogenous variable through the mediating variable. The basis for decision making for testing the proposed hypothesis:

- If the *probability* value of significance > significance α 0.05 or *critical ratio* < 1.96, it can be interpreted that the regression coefficient of the research variable is not significant.
- If the significance *probability* value <0.05 or *critical* ratio> 1.96, it can be interpreted that the regression coefficient of the research variable is significant.

4. Results and Discussion

In this section, the author needs to explain the hardware and software used, dataset sources, initial data analysis, results, and results analysis/discussion. Presenting the results with pictures, graphs and tables is highly recommended. Formulas or evaluation measuring tools also need to be included here. There must be discussion/analysis, and you can't just rewrite the results in sentence form, but you need to provide an explanation of their relationship to the initial hypothesis. In addition, this section needs to discuss and elaborate on important findings.

5. Comparison

Comparison with state-of-the-art is an important part. This section can provide a more measurable illustration of your research contribution. This section can also be added to a brief

discussion. If you feel that this section is insufficient and unsuitable to be a separate section, the author(s) can integrate this section with section four (Results and Discussion).

6. Conclusions

Sections must summarize briefly and concisely the contents of the document or essay. This section may contain (1) A summary of the main results, findings, and evidence from your research or analysis. (2) Synthesis of findings, namely the relationship between findings and research objectives, and show how these findings support arguments or hypotheses. (3) The author may also be able to discuss the implications of research findings for research benefits. What is the contribution or impact on the knowledge or topic discussed? (4) Limitations and suggestions for further research.

Author Contributions: A short paragraph specifying their individual contributions must be provided for research articles with several authors **(mandatory for more than 1 author)**. The following statements should be used "Conceptualization: X.X. and Y.Y.; Methodology: X.X.; Software: X.X.; Validation: X.X., Y.Y. and Z.Z.; Formal analysis: X.X.; Investigation: X.X.; Resources: X.X.; Data curation: X.X.; Writing—original draft preparation: X.X.; Writing—review and editing: X.X.; Visualization: X.X.; Supervision: X.X.; Project administration: X.X.; Funding acquisition: Y.Y."

Funding: Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names. Any errors may affect your future funding **(mandatory).**

Data Availability Statement: We encourage all authors of articles published in FAITH journals to share their research data. This section provides details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created or data unavailable due to privacy or ethical restrictions, a statement is still required.

Acknowledgments: In this section, you can acknowledge any support given that is not covered by the author contribution or funding sections. This may include administrative and technical support or donations in kind (e.g., materials used for experiments). Additionally, A statement of AI tools usage transparency has been included in the Acknowledgement section, if applicable.

Conflicts of Interest: Declare conflicts of interest or state **(mandatory)**, "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interests that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the study's design; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results must be declared in this section. If there is no role, please state, "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

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