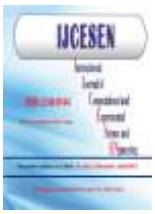
International Journal of Computational and Experimental Science and ENgineering (IJCESEN)

Vol. 11-No.1 (2025) pp. 495-507
http://www.ijcesen.com



ISSN: 2149-9144

Research Article

Social and Cognitive Predictors of Collaborative Learning in Music Ensembles

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Article Info:

DOI: 10.22399/ijcesen.806
Received : 23 November 2024
Accepted : 02 January 2025

Keywords :

Cognitive Predictors,
Collaborative Learning,
Music Ensembles,
Machine Learning techniques.

Abstract:

There have been many attempts to find ways to make music education more relevant and useful for pupils. Learning theories, performance-based learning, contract-learning, discovery-learning, cooperative learning, daily clocking, stage practice, and music-focused required and elective courses are all part of the implementation of these methods. Since high vocational students tend to have lower GPAs, it is imperative that they discover strategies to enhance their academic performance. Reform, rather than relying on theoretical frameworks, should be grounded on practical, innovative human actions. Both instructors and pupils possess the capacity to comprehend what they have learnt, according to the humanistic perspective. This paper provides evidence that collaborative learning is beneficial for first-year music practice students in a popular music program at a Chinese institution. The students work in small, diverse groups. Data was collected and analyzed from students over the course of one academic year with grades 4-6.. Collaboration is a powerful tool that has many applications, including but not limited to popular music degree programs, which is implemented in this paper using machine learning techniques. It zeroed down on seven important characteristics, all of which had obvious applications in the educational process. Another online course could use the method to predict students' performance, including real-time tracking of their progress and risk of dropping out, after it has been adjusted to capture relevant features corresponding to different contexts. This method could also be applied to other management learning platforms.

1. Introduction

Educators in the field of music are all too familiar with the problems of falling enrollment and dismal student retention rates. Interventions to increase retention in music education on a worldwide scale could benefit from a better understanding of the social-cognitive factors that influence student persistence among adolescents [1]. There is growing evidence that learning an instrument may have many positive effects on cognitive function in the elderly; hence, it is critical to define the best way to teach these skills. In the context of learning, social, cultural, and personal variables may impact the efficacy of musical as well as domain-general skill development by learners in later life [2]. Because it may lead to an increase in cognitive function, emotional expression has been the attention of educational researchers and instructors. In certain contexts, one's own subjective and affective experiences might pave the way for future growth and education. Quality instruction, educational change, and the dynamic between teachers and students are all profoundly affected by students' emotional states. Due to music's innate communicative and social properties, group training with it might be a powerful tool for helping youngsters better coordinate their actions, emotions, and thoughts [3]. Students in special education, especially those with learning difficulties, attention deficit hyperactivity disorder, or autism spectrum disorders, may benefit from music therapy as an intervention to improve their behavioral and cognitive development [4]. Students' growth is impacted by music instruction. Due to the fact that music training has a positive impact on all domains, including intellectual, psychomotor, social, and emotional ones, it is imperative that music education curricula emphasize not only the

creation of music but also the experience, analysis, and evaluation of music, as well as the expression of personal feelings, thoughts, and ideas [5]. Music therapy and art therapy provide a great non-pharmacological alternative to traditional pharmaceutical treatments that are effective but may have adverse effects. These therapies can help with symptoms and cognitive, emotional, and social abilities but are safer. In accordance with the PRISMA procedure, 80 papers were reviewed in the SCOPUS and WOS databases and evaluated using a set of predetermined categories and subcategories [6]. Degeneration of brain cells involved in cognitive function precedes that of other brain cells, and this is the genesis of depression. There is currently no treatment for this neurological disorder, which is defined by a decrease in physical, social, as well as cognitive impairment. Dementia patients benefit from nonpharmacological methods, like music therapy, which improves quality of life and decreases behavioral occurrences [7]. Students need to be taught how to work well with older individuals if the population is going to continue to age. An intensive service-learning project was undertaken by students in an online university course on inclusive music practices. The project aimed to strengthen the course learning goals and raise awareness of inclusion concerns across the lifespan, social justice, and disability [8]. When individuals listen to music, it triggers the release of feel-good chemicals like serotonin and feel-good hormones like dopamine. Therefore, in addition to influencing mood, music has other physiological consequences, such as raising the blood pressure, heart rate, and respiration rate. It stimulates a plethora of neuronal pathways and circuits in the brain, including those involved in sensory processing and the processing of auditory information [9]. The area of education has long recognized the critical importance of music education [10]. Social interaction, communication, and emotional reciprocity may be challenging for autistic children. When kids get their hands dirty with music, it may improve their sensory-motor skills, as well as their cognitive and emotional development, and open up new avenues of communication and learning [11]. Scholars in the field of education and learning have taken a keen interest in the ways in which musical training influences students' cognitive capacities. Research indicates that incorporating music into the classroom improves students' learning experiences, which in turn benefits their personal and academic growth [12]. The cognitive, emotional, motivational, and social domains of human development are all positively impacted by musical practice, suggesting alterations in brain functioning. Worldwide and in Brazil, there has been an increase in the total amount of Music Education Programs that target at-risk youth [13]. For example, music is one way in which human distinctiveness has evolved as a result of natural selection. When and why did a wide range of musical styles and genres first appear? Our working theory is that "music" first came from manipulative cries that didn't have many musical components. Subsequently, as social learning progressed, vocalizations were more intricate and adaptable [14]. The music therapy profession is both theoretically and practically complex, making it difficult for teachers to design curriculum that help students develop the skills necessary to apply what they learn in the field, strike a balance between the artistic and scientific aspects of music therapy, and ultimately become lifelong learners [15].

1.1 Aim and Scope

The studies revealed two primary themes: (1) the problems that musicians studying in an ensemble face and (2) the primary advantages of performing and learning in an ensemble, which include the development of life skills and musical abilities. The results indicate that the individuals involved were aware of the beneficial impacts that performing in an ensemble had on their life. Developing one's musical abilities went beyond just picking up an instrument. It was especially noticeable among the younger artists because they had grown in self-assurance and in cognitive abilities like self-awareness and critical thinking. They honed their interpersonal and communication abilities first and foremost. Concurrently, these budding artists were aware that studying music in a group would provide its fair share of difficulties, such as coping with dissatisfaction and adjusting to various approaches to music education. Lastly, recommendations are provided for further research into the efficacy and influence of classical music programs, with a focus on ensemble-based programs and their effects on transferable skills.

1.2 Social and Cognitive Factors in Music Ensembles

Skills that complement one another: learning music encompasses a wide range of abilities, including singing, playing an instrument, dancing, etc. When students work together to learn, they may build on one other's knowledge and expertise, raising everyone's level of competence. Concurrently, via group work, students may put their theoretical knowledge into action while also

improving their musical comprehension and proficiency.

Emotional expression: pupils are able to express themselves via music, and pupils are able to do the same through collaborative learning. Students may learn more about one other's personal experiences and the music they love via working together. In addition to fostering kids' emotional growth, collaborative learning helps them strengthen their communication and emotional expression abilities.

Improve collective awareness and foster a sense of cooperation among students via collaborative learning, which is essential for many musical performances. Collaborative practice teaches students to value other perspectives, appreciate the efforts of others, and develop strong cooperation skills.

Considerations for overcoming obstacles In order to overcome these obstacles, we might consider the following aspects.

Factor 1: Reasonable grouping and collocation

Teachers may logically organize students based to their interests, abilities, and learning styles in music in order to address the collaboration issues brought on by students' unique personalities. To maximize learning and complementarity, make sure that every team includes kids from a variety of backgrounds and with a range of abilities. Simultaneously, educators have the power to inspire students to work together, expand the boundaries of collaboration, and foster intergroup communication and collaboration.

Factor 2: Effective time management

Teachers may alleviate the issue of time management by creating comprehensive lesson plans and timetables that fairly organize the work for each step. Teachers also have the opportunity to help kids develop learning strategies, such as creating a schedule that includes both solo and group work. Furthermore, educators have the ability to monitor pupils' advancement in learning on a frequent basis, identify issues promptly, and provide direction.

Factor 3: Define the role of teachers

Collaborative learning requires instructors to establish their responsibilities. In addition to acting as organizers and guides, they also take part as spectators. When students work together to learn something new, teachers should step back and allow them to focus on what they do best. Concurrently, for collaborative learning to go well, instructors must timely provide students with the appropriate direction and support. Teachers should also be sensitive to their students' emotional needs and push for more group work, mutual aid, and shared achievement.

Factor 4: Establish a good atmosphere for cooperation

Teachers need to create a positive collaborative environment to facilitate students' easy development in collaborative learning. They may plan some team-building exercises to get the kids working together and trusting one another. Simultaneously, educators may inspire their students to showcase their musical creations, assess and critique one another, and ultimately support one another's growth and development. Teachers should also encourage their students to regularly meet in small groups or share what they've learned in order to foster an environment where students are interested in and motivated to study. Finally, it's possible that music education will provide certain obstacles to collaborative learning. However, these obstacles may be successfully overcome and collaborative learning can advance smoothly if we use suitable elements and approaches. We may maximize the benefits and duties of collaborative learning in music education by creating an environment that is conducive to it, using appropriate grouping and collocation strategies, managing our time wisely, and clearly defining our roles as teachers.

2. Related Work

We will go over the existing literature, our research methodology, and how our study helps to close a knowledge gap in the parts that follow. Among Kenyan secondary music students, the links between collaborative learning, perceived task persistence, and self-perception of music are examined in the research [16]. Research shows that students' engagement, learning, perseverance, and performance are all positively impacted by collaborative learning since it exposes them to other viewpoints and ideas. Confidence, drive, and resolve are all bolstered when students have a positive impression of themselves as musicians. While working in groups, students may be subject to comparisons and evaluations that shape their views of themselves and their musical abilities, which in turn affects how they approach and complete assignments. Perceived task persistence was positively and significantly predicted by collaborative education and music self-perception, according to multiple regression models. About 17% of the variation in perceived persistence during tasks was explained by the two factors combined. According to PROCESS-based mediation studies, one's own perception of music mediates, to a lesser extent, the connection between perceived task persistence and collaborative learning.

Adults' participation in learning activities before, during, and after receiving online instruction in music theory, composition, or guitar is discussed in [17]. The participants' data was gathered using a combination of experience sampling and thematic semi-structured interviews. Behavioral, cognitive, affective, and social components of engagement were examined to determine the level of adult learners' involvement in learning throughout and following online music coaching. Flexibility, a predictable and repetitious course structure, and the presence of a supportive learning community all contributed to increased participation during coaching. After the mentoring session finished, however, very few participants persisted in actively composing music. Possible reasons for not continuing included not having enough time or clear enough objectives, although being part of a music-related community outside of the coaching was identified as a factor that might have kept people doing music even after it ended.

That research looks at the correlation between conservatory music teachers' aspirations for social outcomes and their level of satisfaction with SRE during the epidemic [18]. The research, which has its foundations in Social Cognitive Theory, investigates the potential mediating roles of technostress and desire to utilize ICT in that connection. Using an online self-report questionnaire, 108 instructors from Italian conservatories participated in a cross-sectional study. The findings point to technostress as the mechanism via which societal outcome expectations have a detrimental indirect influence on teacher satisfaction. Surprisingly, however, the immediate impact was both good and powerful. Technostress is a result of societal expectations, according to the research. On the other hand, they let music teachers rise to the challenge of online instruction and find more joy in the process.

That research compares the cognitive and motor abilities of healthy older adults who are beginners at the piano to those of a waitlisted control group that does nothing throughout the 10-week program [19-21]. Fifteen people participated in the music facilitator-led piano instruction sessions (two experimental groups and two control groups with a maximum of four students per class). All participants had quantitative data taken before and after a battery of motor and cognitive tests as part of the explanatory sequential design. The waitlisted control group (n = 7) also had post-test data gathered. Qualitative data was gathered via weekly observations by the facilitator, practice diaries kept by the participants, and a single, semi-structured interview conducted after the experiment. Part A of the Trail Making test showed moderate evidence of a substantial beneficial effect of training, suggesting better visuo-motor abilities, according to Bayesian modeling. There was no advantage to cognitive switching, and there was moderate evidence that training had detrimental consequences on part B of the Trail Making Test (in addition to difference score delta). Participants were encouraged to participate in musical groups and mingle by the group learning atmosphere, according to qualitative data.

The purpose of that literature review is to examine the current state of knowledge about the role of emotions in music education, specifically looking at topics such as: opportunities for students to feel and express emotions in the classroom, students' positive emotional experiences in the classroom, strategies for teachers to help students develop positive emotional outcomes, and the positive effects of placing more of a focus on emotions in the classroom. Emotion recognition, regulation, identification, enhanced learning, and self-expression are some of the areas that theoretical research has shown to benefit greatly from music instruction.

That article delves into the idea of opportunities in music education and explains how several kinds of affordances, such as cognitive, educational, mental, emotive, and social affordances, are used in the context of song instruction and student performance. The following are some of the affordances that have been identified in music education: (1) the ability to communicate through music allows students to go beyond the norms of social interaction; (2) historically informed musical procedures and customs show that music is connected to the transmission of aesthetic and sociocultural values; (3) making music together encourages students to be creative and develop their personal growth; (4) learning music exposes students to their own emotional capabilities and expressiveness; and (5) working together to create music fosters the development of relationships and the building of a community that values diversity, equity, and inclusion.

Highlighting the influence on cognitive capacities including memory, language, and mathematics, [22] investigates the function of music as an integral part of the educational curriculum. The study draws on theories like Multiple Intelligences including Social Development Theory to show how music may help with things like emotional control, language development, and problem-solving. Students' mental health, social skills, and academic achievement are all positively impacted by music instruction, according to empirical research. That study examines the benefits of music-based learning approaches, recommends evaluation

models to quantify cognitive improvement ascribed to music education, and proposes practical solutions for merging music into core topics. In the end, it highlights how important it is for educational systems to prioritize music as a fundamental topic, highlighting how it may promote holistic cognitive development and the need of continuing to study throughout life.

That research uses a multi-modal strategy that incorporates neuroimaging methods and analytics powered by AI to examine the effects of music therapy on the cognitive as well as behavioral development of these adolescents [23]. Studying the effects of music therapy on the nervous system using tools like EEG and functional magnetic resonance imaging has led to a better knowledge of the brain processes that underlie improvements in behavior and cognition. The study's overarching goal is to discover the neurological correlates linked to enhancements in social communication, memory, language processing, attention, and emotional control by comparing the patterns of brain activity before and after treatment sessions. In order to create intervention plans that are unique to each student's requirements, neuroimaging data is supplemented with analytics powered by artificial intelligence. In order to personalize music-based therapy treatments, methods for machine learning are used to sift through massive information produced by behavioral and neuroimaging evaluations, find trends, and make predictions.

The purpose of that work is to highlight the benefits of cognitive-emotional music listening and the opportunities it presents in ear training courses [24]. In an effort to mold students' worldviews and enhance their musical competencies, cognitive-emotional music listening targets listening to, comprehending, and appreciating classical music. An interdisciplinary and multimodal approach to a musical composition may accomplish that. In that course, students learn not only how to compose music but also how to analyze and assess it, as well as the theoretical and harmonic aspects of the piece, as well as the historical and musical background of its creation in a specific period and place. You can learn more about a musical piece and its details by listening to it or parts of it multiple times, taking note of it from various angles, and then talking about what you heard and how it made you feel. That practice can also help you discover and improve yourself, accept others, and embrace what makes them different.

Examining how music education affects students' cognitive development, classroom engagement, and academic accomplishment is the goal of that research [25]. In particular, it investigates the relationship between students' musical knowledge and their academic achievement. Improvements in cognitive capacity, social and emotional well-being, the capacity to think critically, financial obstacles, and time restrictions are only some of the aspects investigated in the research. A total of 150 students participated in the study by filling out an online survey; the research strategy included testing hypotheses and analyzing data using SPSS to run tests like the T-test and Pearson correlation. The results show that compared to Group 2, students in Group 1, who had more music instruction, performed better academically and showed more competency in their studies. The study's findings highlight the importance of music education in improving cognitive development via its favorable impact on students' academic performance and its inclusion into the educational curriculum.

3. Methods and Materials

Taking a look at things from the perspective of young musicians, our research explores how being a member of classical music groups affects their skill development. Participation in ensembles or orchestras, as well as other group musical activities, has been shown in earlier studies to promote the development of musical and life skills that span the cognitive, emotional, as well as interpersonal domains. However, the question of whether training in a musical ensemble affects transferable talents remains unanswered. Given these factors, it is clear that more qualitative studies involving adolescents (those between the ages of 12 and 18) are required to fully understand the range of experiences, both positive and negative, that characterize this developmental period. This method promotes a more thorough comprehension of the experiences of young musicians while recognizing the variety within the teenage group. Both this study and future ones may benefit from include teens of varying ages in order to provide a more complete picture of how music education affects these young people. This wide age range also allows us to better understand the similarities and differences among the experiences of teenagers who play in classical music ensembles, which expands the scope and depth of the research.

3.1 Research Questions

In this work, we answer the following study inquiries based on the prior literature review:

- RQ1. Through participating in classical music groups, how do you think young musicians have grown musically and personally?
- RQ2. How do young musicians deal with the difficulties they face?

- RQ3. In an ensemble setting, how can students make sense of the cultural, social, and musical influences exerted by their instructors?
- RQ4. In light of this knowledge, how might students approach the practical application of their choices about their cognitive, behavioral, and emotional learning?
- RQ5. How does this introspective journey impact their views of themselves as artists, creators, and leaders-in-the-making?

3.2 Research Findings

Finding out what young musicians think are the pros and cons of studying music and playing in groups, particularly in terms of life skills, was the main goal of this research. To get a feel for the issue under study, we'll use qualitative data to look into this goal. The intricacy of human feelings, thoughts, and actions may be better comprehended via qualitative analysis, which draws on participants' first-hand accounts. This study delves into the viewpoints of teenagers to illuminate their musical experiences and the ways in which they impact their day-to-day lives. Although familiarity with the educational setting is necessary for placing the outcomes of the qualitative research stage into perspective, the results themselves offered the most important takeaways from that stage.

3.3 Research Design

Utilizing a sequential explanation within an intervention design, the present study gathered quantitative data before and after the intervention, as well as qualitative data during and after the intervention. This was done within the framework of an intervention study using pre/post data collection. As a result, we were able to record not only the participants' objective impressions of the program, but also their development of domain-specific fine motor skills, general cognitive abilities, and instrument-specific abilities. After the second round of testing, individuals were either placed into an active group of experiments or placed on a waitlist to receive music instrument instruction. Following the completion of the intervention, members in the control group were also administered additional post-tests.

Social support—parents, instructors, and peers—affects music performance anxiety, chain-mediated self-efficacy, and emotional intelligence, which affects educators, university authorities, and students. Understanding these ramifications may help musicians reduce performance anxiety. Some notable practical effects:

- Parents contribute to children's confidence and emotional development. Fostering and appreciating a child's efforts might boost self-efficacy. This help reduces performance anxiety by encouraging students to believe in their musical ability. Parents may model empathy, emotional regulation, and constructive emotional expression. Open talks about emotions, contemplation on music-related feelings, and understanding and support during performance-related stress may achieve this.
- Music teachers and professors directly affect students' musical confidence and emotional intelligence. They may do this by creating a welcoming, helpful learning environment where errors are accepted. This strategy reduces performance anxiety by reducing the fear of negative feedback. Teachers may also teach performance skills and anxiety-reduction practices including mindfulness, breathing, and positive visualization. Emotional intelligence in the field of music, such as teaching students to understand and express their emotions via music, may also promote emotional control.
- Peer support amongst musicians, especially in ensembles, reduces performance anxiety. Encouragement and empathy from others reduce isolation and competition, which may lead to performance anxiety. Sharing experiences and coping methods with others helps normalize performance anxiety and provide practical answers. Promoting a collaborative and supportive atmosphere during group performances might reduce anxiety by focusing on collective achievement rather than individual failure.
- Music schools and departments may create performance anxiety support programs that include parents, instructors, and peers. These programs may include parent lectures on how to assist their child's musical journey, teacher training on interpersonal skills and anxiety management, and student peer mentoring or support groups. Such programs may provide full assistance for musical skill development (self-efficacy) and emotional intelligence (in performance).

3.4 Participants

This research was approved by the appropriate human ethics committees. Approval was contingent upon the researcher's ability to appropriately handle the imbalance of power between themselves and the student participants. The teacher/researcher skillfully navigated this connection by regularly reflecting on their own actions, doing research in a

way that was both compassionate and non-exploitative, and by strictly adhering to the ethical values of justice, respect, beneficence, and informed consent. Students who have finished the first year of music practice for at least two semesters (or one academic year) were eligible to participate. The research had a total of ten participants. The gender ratio was about 1:1, and the majority of students were between the ages of 17 and 20 (n=7), with a small number of students aged 30 and over (n=3). The pupils' instrument breakdown was as follows: half sang, half played piano, one played guitar, one played drums, and one played saxophone.

The reporting and discussion of outcomes use pseudonyms for the students who participated. Students' names will not be included here with their primary instrument because of the limited sample size and the potential for identifying issues. Keep in mind that the research did not include children whose enrollment was canceled during the school year. As a result, we will never know whether these students' choices to stop were influenced by collaborative learning or not.

3.5 Data collection and analysis

Students' attendance and test scores, as well as their responses to three short-answer surveys given at various points throughout the school year, were used to compile data in compliance with the VCF. We slightly altered the questions from the VCF so that they were more like "open" questions that encouraged students to reflect on their own work. These were given out during class at certain intervals throughout the year to check for student attendance. Since the surveys asked students to think critically about what they had learned, they were deemed a suitable use of class time. In an effort to save class time spent on questionnaires and prevent students from experiencing "questionnaire fatigue," it was decided to combine questions from cycles 3, 4, and 5 into a single examination. Not a single student who participated in the research did not return a survey. In order to promote persistence in music education on a worldwide scale, it may be helpful to identify social-cognitive variables that may be predictive of persistence among adolescents. Among Kenyan secondary music students, this research examines the connections between collaborative learning, self-perception in music, and perceived task persistence via the use of quantitative parameters. Research has shown that students' engagement, learning, perseverance, and performance are all positively impacted by collaborative learning since it exposes them to other viewpoints and beliefs. Confidence, drive, and resolve are all bolstered when students have a positive impression of themselves as musicians. While working in groups, students may be subject to comparisons and evaluations that shape their views of themselves and their musical abilities, which in turn affects how they approach and complete assignments. Perceived task persistence was positively and significantly predicted by collaborative study and music self-perception, according to multiple regression models.

Fifteen people participated in the music facilitator-led piano instruction sessions (two experimental groups and two control groups with a maximum of four students per class). All participants had quantitative data taken before and after a battery of motor and cognitive tests as part of the explanatory sequential design. The waitlisted control group (n = 7) also had post-test data gathered. Participants were encouraged to participate in musical groups and mingle by the group learning atmosphere, according to qualitative data. Participants were most motivated to learn how to play known songs when they were satisfied with the repertoire selection and the facilitator could see that their groups had developed strong ties. Based on these considerations, exploratory studies showed that a participant's lesson class significantly affected their post-test results (TMT part A). The significance of taking group dynamics into account in a classroom setting is shown by these findings, which also show how much older persons may improve cognitively from a brief intervention in piano instruction.

3.6 Machine Learning Methods

In order to examine correlations between several variables or predictors, logistic regression (LR) is often used. While regression modeling is often used to forecast a result with a new predictor, regression analysis is typically used to characterize interactions between variables or predictors in order to construct a linear functional model. The LR model is a kind of binary regression. Because of its ability to provide hierarchical or tree-like structures, the LR approach is used in machine learning for the creation of categorization models. For classification and prediction, LR has been used by many sectors.

Supervised learning methods like support vector machines (SVMs) may provide robust Hyper Plans for categorical data classification. Nonlinear or high-dimensional classification is the typical use of the SVM. There are a plethora of helpful kernels that may lower false positive rates and boost classification performance.

Classifiers known as Naive Bayes (NB) rely on the Bayesian theorem and a naïve assumption of

independence among the characteristics or predictors that are used. When it comes to bundles with kernel density estimation, NB classifiers provide better accuracy. In addition, they provide a great deal of leeway for classification problems involving linear or nonlinear relationships between features and predictors. Computing the cost is linear when compared to costly iterative classifier approximations.

4. Results and Analysis

4.1 Questionnaire Design

Results from the general and cognitive tests were analyzed quantitatively in this research, while data from interviews, practice diaries, and observations were analyzed qualitatively. After collecting data, we ran quantitative analyses to see if our null hypothesis that training would improve motor and cognitive skills held water (confirmatory analyses). Then, we used the results of our exploratory analyses to draw conclusions about any possible class differences.

In Phase 1 of the semi-structured interview technique, we inquired about the participants' expectations for their educational experiences and their views on the potential benefits they may get from their instructors. In the second stage, we looked at how students' ideas, views, and memories of the learning relationship impacted their learning, independence, and self-assurance as improvising musicians. Although there was a pre-designed interview plan and protocol of questions to serve as a guide, we modified the questions to adopt a more conservatory approach in order to foster participants' freedom of speech. Three overarching themes emerged from the three research topics, and they were all covered in the general interview methodology shown in Figure 1. Teachers' abilities and aspects of their practice were considered by participants as factors that aided in their own self-discovery, creative growth, and ability to confidently improvise musically. In order to "convey the significance of the oral presentation in an interview," interviews were audio recorded and transcribed word for word. This qualitative method articulated a "cognitive, meaning-disclosing component to what we experience" and placed an emphasis on the participant's subjective reality.

SEM Analysis

The data was analyzed using the ANOVA program, with Structural Equation Modeling (SEM) serving as the primary statistical tool for this investigation. SEM is an effective statistical tool for examining complex relationships between variables that are both observable and underlying. Within the model, it permits evaluation of both direct and indirect impacts. Parental support, instructor support, peer support, self-efficacy, emotional intelligence, and performance anxiety in music are just a few of the many factors that may be evaluated using structural equation modeling (SEM).

Because it records the anticipated relationships between latent variables (unobserved constructs) and, in some cases, between latent and seen variables, the structural model is a crucial part of structural equation modeling (SEM). A series of regression-like equations that reflect causal assumptions are the building blocks of this model, which is sometimes visually shown as a path diagram. These equations connect latent variables via directed pathways. The strength and direction of these interactions are measured by the paths' coefficients.

The authors may see that logistic regression yields the best results in terms of test accuracy and F1-score from table 1. The results of the SEM for both undergraduate and graduate students are shown in table 2. Among both undergraduate and graduate students, there is a favorable correlation between parental, instructor, and peer support and self-efficacy and emotional intelligence. Anxiety before performing music is strongly correlated with EQ and self-efficacy. Undergraduate and graduate students' levels of anxiety about performing music are more mitigated when they have the support of their teachers, as opposed to when they rely on their parents or classmates. Students do not show as strong of an association between emotional intelligence and self-efficacy as do graduate pupils.

To ensure the precision and reliability of our findings, ANOVA supplemented this process with advanced modeling capabilities, visual representation of the models, and rigorous statistical analysis. Table 4 shows the results of the fit test for the social-cognitive model of exercise behavior using latent variable structural equation modeling. To evaluate the model's fit, we used R2 and the path coefficients. We checked that all of the variables were normally distributed before running the SEM. In order to apply SEM to data that does not follow a normal distribution and has a limited sample size. Through a sequence of ordinary least squares regressions, LR-SEM maximizes the percentage of the variance explained for one or more endogenous components specified in the SEM. This SEM approach is part of structural equation modeling (SEM). It is an iterative procedure that guesses the route coefficients in the structural model by first analyzing the measurement model blocks independently; this approach is known as a component-based estimation method. The difference between the observed and SEM-

predicted values for both sets of data was used to determine the raw data residuals. Multiplying the raw regression parameters acquired using SEM with the corresponding actual values of the predictor variables allowed us to determine the predicted values. If we take the back-transformation of the SEM parameters, S, and divide it by (1-S), we get the chances that each independent variable is true; adding these odds together for all independent variables gives us the odds that each profile of independent variables is true. If the chances were more than one, we said that the SEM predicted instances were true and that the others were false. Using an estimated probability cutoff of 0.5 for the outcome variables, logistic regression determined the percentage of properly categorized outcomes. A small random sample of 100 observations was collected from the simulated data set of 5,000 observations, and the classification performance of logistic regression and SEM were tested on a real data set containing different obstetric outcomes of interest. An integrated analysis of the measurement and structural model allows for the integration of the measurement errors of the observed variables into the model, and it combines factor analysis with hypothesis testing in a single procedure. The model's indicators were all considered to be reflections of the corresponding constructs. $P<0.05$ was used to establish statistical significance.

Model Fit Index

Here are the structural model fit indices as shown in table 3.

4.2 Performance Results

To assess how well the model performed, the testing datasets were used. The popular index usually makes advantage of the proven performance of the offered techniques. When evaluating the accuracy, sensitivity, specificity, NPV, PPV, and kappa value of a model, as well as its appropriateness, a confusion matrix is often used. The six assessed values, or indices, were arranged in ascending order based on the kappa value.

All of the attributes and samples must be used by the decision tree algorithm. Furthermore, the training depth grows in tandem with the tree, making overfitting a more likely outcome and lowering verification accuracy. Despite adjusting its hyperparameters from 1 to 20, logistic regression and random Forest still outperform it in terms of training accuracy. Nevertheless, random forest is a more sophisticated variant of decision tree that incorporates numerous decision trees. Each decision tree employs a subset of the sample's attributes, reducing the data and features in a decision tree and so reducing the likelihood of over-fitting. In addition to being just as effective as random forest in preventing overfitting by removing irrelevant characteristics from the model, logistic regression performs as well in terms of test accuracy. Logistic regression has a rapid training time and a computation cost that scales with the number of specializations. The superiority of logistic regression is evident. All of the attributes and samples must be used by the decision tree algorithm. Furthermore, the training depth grows in tandem with the tree, making overfitting a more likely outcome and lowering verification accuracy. Despite adjusting its hyperparameters from 1 to 20, logistic regression and random Forest still outperform it in terms of training accuracy.

Logistic regression, in conclusion, provides the strongest results when analyzing loan forecasts. Its minimal memory footprint—resulting from storing just the eigenvalues of any dimension and without scaling the input features—makes it well-suited to dichotomous classification tasks. Lastly, the model is easy to understand and work with as logistic regression is the simplest of the three. The weight of characteristics allows one to see how various aspects impact the end outcome. The outcomes were remarkable. In this analysis, a yes/no default payment was used as the dependent variable. Our next step was to compare the destination's score to the results of our classification. The investigation was carried out on a local workstation using the Jupyter Kernel and Python. This research identifies eight main characteristics that explain... What follows is a more detailed description of these variables: (i) X1: Age (ii) X2: Course of Study (iii) X3: Current Occupation (or Total Years in the Field) (iv) X4: Numeric Equivalent of Address - Demographic Area (v) The income is represented by X5, the debt is represented by X6, and the credit to debt ratio is X7. X8: Additional Debt.

The pre-processed data set was used to train our classifier, through the feature default as the goal. Confusion Matrix, Accuracy, F1-Score, Recall, Precision, ROC area, and Feature Importance are the seven metrics used for assessment. Since this is a classification method, and the predicted variable's value is binary, we have used the confusion matrix with these evaluation metrics. Metrics for evaluation such as Accuracy, Precision, Recall, etc., greatly improve the likelihood of discovering and fixing the algorithmic problem. By doing so, we may enhance the results using the same assessment measures while progressively reducing the scope of change, leading to even better outcomes.

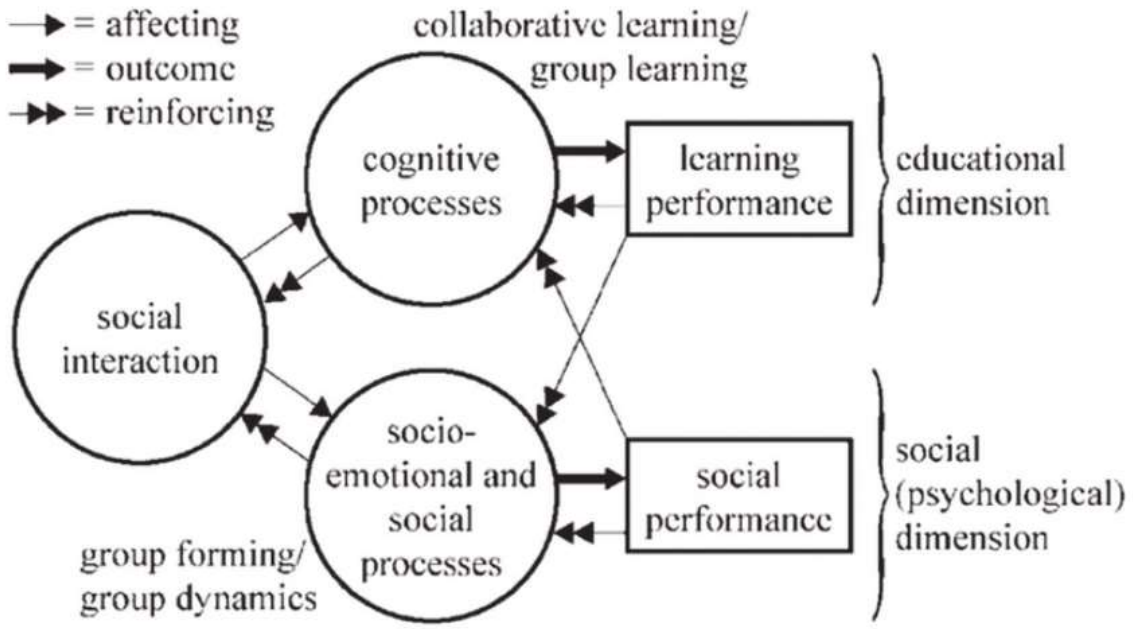

Figure1. *Cognitive and Social Relationship Between in Music Ensembles*

Table 1. *Questionnaire Form for Interview Plan*

Questions	Satisfactory Level				
How learning took place?	Above average	Average	Satisfactory	Poor	Very Poor
Make recommendations for enhancing these group efforts.					
Explain the role that self-reflection plays in your educational journey.					
To what extent did you find value in the teacher-student dynamic?					
Give an example of how you modified or adopted a part of what you learned					
During the nine months of the curriculum, how did you approach things similarly or differently?					
What have you learned about this issue from your involvement with it?					
What learning took place?	Above average	Average	Satisfactory	Poor	Very Poor
In what ways did your confidence in your creative abilities grow as a result of your educational experiences?					
In your opinion, what was the most significant thing you brought to the group?					
What did you gain from working together?					
Tell me about your self-image and how you feel about your abilities as an improviser?					
Who the learning connection was made with	Above average	Average	Satisfactory	Poor	Very Poor
What was the impact of teacher discussion/dialogue on your learning process?					
What were the most useful aspects of this collaboration?					
What was the impact of the guest artists on your learning?					
How did peers contribute to your knowledge and sense of shared ideas?					

Table 2. *SEM Analysis for Different Variables*

Construct	Variables	Range	Kurtosis	Skewness	Mean	S.D
Grade 4	Parents	4.67	1.89	-1.46	5.28	1.19
	Music schools and departments	4.67	2.14	−1.52	5.30	0.93
	Peer support among musicians	5.00	1.14	−1.06	5.44	1.07
	Music professors and instructors	4.67	2.47	−1.15	5.31	0.92
Grade 5	Parents	5.25	1.28	−1.40	4.90	1.40
	Music schools and departments	4.50	2.00	−1.42	5.25	1.06
	Peer support among musicians	4.25	1.47	−1.34	5.63	1.01
	Music professors and instructors	5.75	1.97	−1.24	5.30	1.10
Grade 6	Parents	5.25	1.28	−1.40	4.90	1.40
	Music schools and departments	4.50	2.00	−1.42	5.25	1.06
	Peer support among musicians	5.00	1.14	−1.06	5.44	1.07
	Music professors and instructors	4.25	1.47	−1.34	5.63	1.01

Table 3*. Fit indices of the structural model*

Model fit index	Acceptable levels	Obtained fit estimates	Interpretation
df	< 0.05	4	Better
TLI	> 0.8	0.94	Excellent
P	< 0.05	0.02	Excellent
RMSEA	< 0.08	0.070	Excellent
CFI	> 0.90	0.99	Better
x^2/df	< 5	2.92	Excellent
x^2	< 0.05	11.715	Better

x^2: (CMIN), x^2/ df; Minimum discrepancy, CFI, comparative fit index; RMSEA, root mean square error of approximation; TLI, Tucker Lewis index.

Table 4: *Summative outcomes of three approaches on the sample under examination.*

method	Accuracy	F1-score
Decision tree	78.2%	0.879
Random forest	85.5%	0.866
Logistic regression	87.42	0.912

4. Conclusions

The field of music education greatly benefits from cooperative learning. Students may get even better learning outcomes by refining their approach to learning. The effectiveness of cooperative learning depends on reasonable group collocation, appropriate time management, explicit instructor role placement, and a pleasant cooperative culture. Simultaneously, the key to consistently improving the learning impact is to optimize and enhance the learning technique. Students' interest in and desire for learning, as well as their mastery of musical and nonmusical skills, may be enhanced via the ongoing process of adjusting and improving learning procedures. Consequently, it is crucial to maintain a focus on optimizing and improving learning processes in music education. This will help us satisfy the learning requirements of students and support their overall growth.

Students reaped benefits from collaborative learning because they learned from one another, which enhanced their performance and helped them develop new abilities; as a result, they rethought what it meant to be successful musically and personally. Collaboration is a powerful tool that has many applications, including but not limited to popular music degree programs. Machine Learning techniques has been widely studied and reported a number of works [26-40].

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.

- **Author contributions:** The authors declare that they have equal right on this paper.
- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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