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Investigating 'Xindi Piano Teaching Method' for music education in schools

Lanqing Ye[1], Yaoping Liu[1], Wannaporn Siripala[1], Tassanee Laknapichonchat[1], Yudhi Arifani[1,2]
[1]Department of Education and Society, Institute of Science Innovation and Culture, Rajamangala University of Technology Krungthep, Bangkok, Thailand
[2]Department of English Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Gresik, Gresik, Indonesia

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ABSTRACT

This study examines the "Xindi Applied Piano Pedagogy" and its effects on the career growth of music teachers at the elementary and secondary school levels. It highlights the need to further study the integration of culture into music teaching through technology-enabled instructional design. The research is conducted with 12 students from three participating schools selected for the "Xindi Applied Piano Pedagogy" program through in-depth interviews. It is grounded in theory with a three-level coding system. The study suggests a three-step model for training music teachers: first, establishing a comprehensive educational framework; second, increasing subject scope and implementing concentrated instructional strategies; and third, evaluating students in a meaningful way that necessitates systematic changes to the curriculum. The study points out the synergistic interaction between higher educational institutions, elementary schools, and research institutions in "Xindi Applied Piano Pedagogy" that form a unified process of teacher training. It applies the deschooling theory in the pedagogy to encourage creative development as "Xindi Applied Piano Pedagogy" illustrates. This model brings together universities, research centers, and industries to create inventive ecosystems and utilizes plan, do, check, act (PDCA) cycles for continuous quality improvement. Further analysis of this approach in classroom settings is recommended by the study.

Corresponding Author:

Wannaporn Siripala
Department of Education and Society, Institute of Science Innovation and Culture
Rajamangala University of Technology Krungthep
2 Nang Linchi Road, 10120 Bangkok, Thailand
Email: wannaporn.s@mail.rmutk.ac.th

1. INTRODUCTION

In the modern environment of globalization and the internet age, music education becomes one of the vital conduits for developing students' overall quality and creative prowess [1]. Research into teachers' professional development and pedagogical praxis, as well as the creation of educational paradigms and pedagogical methodologies, are essential to the advancement of high-quality music education [2]. Due to its unique pedagogical theory and practice, the extensive "Xindi Applied Piano Pedagogy" teaching system has attracted a lot of attention from the academic community [3], [4]. The methodology underscores a student-centric approach, enhancing students' comprehensive, applied, and creative competencies through innovative teaching strategies and many pedagogical activities [5]. At many levels, "Xindi Applied Piano Pedagogy" is studied, but its practical usage lacks intense constructive research as noted in Ye [6]. Regarding training piano tutors for primary and secondary music teaching's pedagogical disciplines. The knowledge innovation by primary and

secondary school music teachers is highly pivotal for the advanced quality of music education. Therefore, research and analysis of "Xindi Applied Piano Pedagogy" concerning these teachers is very important both in theory and practice in fostering innovative changes to improve educational standards in teaching music [3], [5].

In addition to curriculum design, this research works on workflows, philosophies, and all aspects of teaching "Xindi Applied Piano Pedagogy" to music teachers with practical experience at primary and secondary educational levels. This study applies grounded theory in qualitative research to analyze the pedagogy's model, process, outcomes, dynamics, influences, attributes, and various constituents that guide training music teachers to these levels. The teaching of piano within the context of modern educational practices has moved beyond traditional approaches [7]. There has been an increase in blended learning, which combines face-to-face instruction with digitally available resources [8]. This has advanced further with the integration of digital pianos and music software, as well as the availability of online resources, which transforms piano teaching into interactive learning tailored to individual students' preferences and rates of progression [9]. Students can receive immediate feedback which greatly enhances the process of education, alongside an extensive repertoire, the ability to record, and playback their performances [10].

Discussion on modern approaches to teaching piano emphasize the need to foster creativity and self-expression [11]. Teachers are encouraged to move beyond the basics of teaching how to read and play music. Instead, learners should be encouraged to compose and devise their own interpretations of pieces [12]. This can be achieved through improvisation and composition assignments, as well as analyzing the emotional aspects of music and the stories that lie within [13]. Peer learning is another important approach, where students collaborate to learn through group classes, ensemble sessions, and performance workshops [14]. These activities develop not only their musical abilities, but also their confidence and social skills.

Supporting creativity and self-expression in piano teaching processes requires an all-encompassing strategy [15], [16]. First, improvisation should be welcomed where students try out different combinations of sounds, rhythms, and melodies as deep as their imagination can stretch [17]. Logically, the next step which should be encouraged is composition [18]. Composing one's own music helps students understand music theory better and allows them to express emotions and ideas through music [19]. Besides, interpretation should be provided for trying to enact and play pieces the way students want to and in a manner that expresses their individuality and creativity [20]. Experimenting with different sounds and effects increases creativity. Students should be provided with music software and applications that pose new challenges. In addition, the environment should have encouragement and a non-threatening atmosphere for sharing work so students can feel free to go beyond their self-imposed limits [21]–[23].

The "Xindi Applied Piano Pedagogy" is a multifunctional model which integrates research, teaching, and other related activities in the training of music educators to be taught in higher learning institutions [24]. It focuses on the interactions and relationships between the institutions which conduct scientific research, the educational and practical training institutions, and the researches that are carried out on the instruction systems [25]. The scientific institutions bearing the brunt of research are responsible for designing new and revolutionary concepts and techniques of teaching and learning piano playing [26]. The academic activities are performed by the educational institutions which apply the new techniques in their comprehensive curriculum of teaching piano in outline form. The associated training activities are performed by the actual work teaching practice providing institutions for the trainees [19].

As stated in one of the reports, "Xindi Applied Piano Pedagogy" practically implements a holistic method of teaching a piano class at a graduate level [27]. This approach has been found beneficial in improving a learner's creative thinking as it allows them to experiment with a variety of sounds, rhythms, and melodies [4]. It also promotes composition by asking learners to put together their own pieces which helps them understand music theory better and lets them express their emotions and ideas [3]. It also enhances interpretation by allowing learners to perform songs in their own style to encourage self-expression and individuality. It incorporates technology by using music software and applications that allow learners to manipulate a myriad of sounds and effects which encourage their creativity [19]. Lastly, it cultivates a supportive environment, providing positive feedback and a safe space for students to share their work, boosting their confidence and motivation to express themselves creatively [28].

Researchers frequently ignore the relationship between technical proficiency and emotional expression, resulting in performances that, while technically sound, lack emotional depth. This barrier, along with others such as students' difficulties expressing emotions owing to a lack of self-confidence or excessive emotional display, necessitates additional research. Furthermore, the incorporation of traditional cultural components into music instruction, which enriches the learning experience and promotes cultural identification, is sometimes overlooked, indicating the need for future research in this area. As a result, this study recommends two research issues:

- What are the key methodological phases of the "Xindi Applied Piano Pedagogy", and how do they contribute to the training of music educators in primary and secondary schools?

- How does the "Xindi Applied Piano Pedagogy" model its training pathway for music educators in elementary and secondary schools, and what are the outcomes of this training?

2. METHOD

2.1. Research design

This study employs grounded theory, a qualitative research method that develops theory through real-world observations and analysis. It highlights the relationship between theory creation and empirical evidence by generating and constructing hypotheses from raw data. The technique fosters an open-minded attitude, allowing for the detection of patterns and links through constant data comparison, resulting in a better knowledge of the phenomenon and the progressive creation of ideas.

2.2. Sources of data, instruments, and respondents

The 2 post-secondary educational institutions, the School of Music Education at the Xinghai Conservatory of Music and the School of Humanities at Guangzhou Chengjian College of Vocational Studies, along with one primary school, Guangzhou Haibang Primary School, have been selected for this study to investigate the implementation of the "Xindi Applied Piano Pedagogy" within the pedagogical mechanism of music educators in primary and secondary schools. These institutions work together in pedagogy research, academia, and industry. With a focus on doctoral students who specialize in "Xindi Applied Piano Pedagogy" and are directly involved in teaching and administration, the study primarily focuses on the leaders, educators, and administrators of the institutions involved in the pedagogy's instruction by use of extensive, semi-structured interviews with 12 respondents.

The index of item-objective congruence (IOC) project test for the "Xindi Applied Piano Pedagogy" includes a thorough interview syllabus in the primary and secondary music teacher training mechanism. The goals of innovative talent development, curriculum, textbook systems, teacher team building, and the efficacy of teaching material, technique, and application evaluation are only a few topics covered in the assessment content. The test aims to verify if the "Xindi Applied Piano Pedagogy" effectively develops primary and secondary school music teachers' creative abilities.

The review covers multiple aspects as checking if the model's training goals are aligned with actual work expectations, checking if the teaching materials are appropriate and accurate, and if the curriculum has a scientific and rational framework. It also checks the level of professionalism and teaching skills of the teacher's team and the scientific, innovative and practical degree of the content taught. The teaching methods are evaluated based on the variety, responsiveness, and the degree of flexibility to different levels of operationalized learning standards for achieving instructional objectives. Evaluation methods receive thorough attention for fairness and accuracy in reflecting the true learning of students.

Information was collected through surveys, observations, and student grading during the test. The approach was later assessed regarding its effectiveness in syllabus and curriculum development and gave suggestions for further improvement. Important usable information came out from expert interviews and concrete corrective measures were suggested. Working research interview framework on a topic "Xindi Applied Piano Pedagogy" for teaching training in primary and secondary school had learning goal, curriculum, teaching, managing, materials, and assessment dimensions which enabled a comprehensive evaluation of the pedagogy in music education.

To ensure accurate data collection, semi-structured interviews were conducted with 12 key personalities from 3 educational institutions that use the "Xindi Applied Piano Pedagogy" in their teacher training curriculum. The audio recordings were transcribed verbatim and properly scrutinized. The interviews were then classified and coded using grounded theory to better understand teaching and learning techniques. Transcripts were edited for accuracy, provided to interviewees for approval, and, with their consent, used as the primary data source for the study. Table 1 displays the information from the interview table.

2.3. Data collection

The researcher utilized the 3-tier coding strategy, open, axial, and selective coding proposed by Luo and Yang's [4] theory to arrange the data during the data gathering phase of this study by assisting in the achievement of clear thinking and a more definite hierarchy. The three-level coding system aids the researcher in summarizing and generalizing research findings with greater clarity. Grounded theory, which employs a systematic set of analytical procedures like open coding, axial coding, and selective coding, was chosen by the researcher as the primary research methodology for examining the effect of the "Xindi Applied Piano Pedagogy" on the training mechanism of primary and secondary school music teachers. This study analyzed the "Xindi Applied Piano Pedagogy" model of training music teachers for basic and high school levels.

The study took a full year, beginning with defining the research topics. Using a concurrent approach to data collecting and analysis, the researcher first set out to choose the sample and create the interview schema.

Further sample selection and interview schema refining were based on the preliminary research observations. By using a three-level coding procedure and ongoing comparative analyses of the material obtained from the interviews with the 12 participants, the research moved on to the next stage. In order to do a saturation test of the theory, the researcher developed a cohesive collection of questions and gave them to the 12 interview subjects in the last phase.

Table 1. Basic information sheet for respondents

Teacher code	Gender-based	Source	Interview ID	Duration
X1	Male	Xinghai Conservatory of Music	Leaders	1:38
X2	Male	Xinghai Conservatory of Music	Managers	2:30
X3	Male	Xinghai Conservatory of Music	Teachers	1:53
X4	Women	Xinghai Conservatory of Music	Teachers	1:16
X5	Women	Xinghai Conservatory of Music	Teachers	1:26
X6	Women	Guangzhou Urban Construction Institute	Leaders	1:36
X7	Male	Guangzhou Urban Construction Institute	Managers	1:56
X8	Women	Guangzhou Urban Construction Institute	Teachers	0:56
X9	Women	Guangzhou Urban Construction Institute	Teachers	1:06
X10	Male	Haibang secondary schools	Leaders	0:56
X11	Women	Haibang secondary schools	Managers	1:12
X12	Male	Haibang secondary schools	Teachers	1:35

2.4. Data analysis

Following the grounded theory coding guidelines, this study was conducted in 3 main stages. First, data regarding the "Xindi Applied Piano Pedagogy" in elementary and secondary music education from 12 interviews were subjected to open coding. Based on the first coding results, links between concepts were next investigated using axial coding. Ultimately, a crucial area was chosen to thoroughly examine the methodology's impact on training music educators, resulting in the development of an all-encompassing theoretical framework. This iterative and nonlinear research process keeps improving and expanding the theoretical model by incorporating additional interview data.

3. RESULTS AND DISCUSSION

3.1. Results of methodological phases

3.1.1. Open coding

After a thorough coding examination of the 12 sources for this study, numerous integrations, summary, and classification rounds were conducted to eliminate irrelevant concepts and content. The 35 major categories and 156 original concepts emerged from this procedure, as in Table 2 (see in Appendix). The only information provided is representative data, preliminary concepts, and the related categories and dimensions due to the amount of raw data in the open coding stage.

The study reveals a holistic approach to piano education, starting with identifying significant issues such as improving instructional objectives and adapting individuals' diverse piano talents. This resulted in the creation of a customized teaching approach, including a curriculum adapted to each student's abilities and implemented in digital piano group lessons. The curriculum was supplemented by a textbook with 13 modules for students of various ages and abilities, which used a variety of materials. To improve the program, a teaching and research department was formed, with teachers trained and appointed by the program. The curriculum's success was frequently assessed using a variety of ways to provide a comprehensive and effective piano instruction program.

3.1.2. Axis coding

Secondary coding, or axial coding, is a research phase that uncovers and builds relationships between research concepts and their primary classifications, highlighting the inherent links within the data. As the study advances, the connections among the identified classifications become increasingly apparent, as in Table 3. The researchers employ a comparative method to connect these relationships, forming a preliminary framework centered on talent development theory.

Following axial and open coding techniques, 12 main categories with associated ideas, explanations, and conversations pertaining to talent development were identified. These areas include instructional goals, curricula, pedagogical approaches, delivery of curricula, professional development for teachers, educational practices, student empowerment, personal growth, educational resources, teaching assistance, and systems for evaluation and feedback.

Table 3. Axis coding

Primary category	Taxon	Initial concepts
Integrated student development	Skill differentiation, target refinement	Teaching objectives must be refined to accommodate students' varying piano skill levels.
Clarification of teaching objectives	Differences in student ability limit teaching and learning	Teachers have clear instructional goals, but differences among students may limit the achievement of goals.
Unified curriculum	Adaptation of student competencies, diversity of curricula	The content and difficulty of the teaching are individually adapted to the student's ability, and a wide choice of courses is offered.
Practice-oriented	Extended hours, practical experience	By emphasizing the importance of practical teaching throughout the education cycle, it is recommended that more classroom time be devoted to deepening practice.
Group lesson	5-position integrated teaching	Integrate a variety of piano teaching modes into group lessons to meet different learning needs.
One to one	One-to-one teaching	
Combination of playing and singing	Differences in student levels	Individualized plans are tailored for each student to meet the challenges of differing skill levels.
	Combined teaching of playing, playing, and singing	A combination of strumming and playing methods are taught to suit different student ability levels.
Situation-based selection of teaching materials	Different age and skill adaptations	The materials in the 13 modules apply to different learning stages and skill levels, ensuring application and variety.
	Differences between large classes and one-on-one instruction	Separate teaching materials suitable for group teaching and individual instruction are used to suit different teaching scenarios.
Multi-module textbook selection	Quality education teaching materials aligned with industry-academia-research projects	The primary school program uses teaching materials designed for quality education and is integrated with the needs of the actual industry.
Course comprehensive learning	Full-time faculty building industry-academia-research project faculty	A professional development space that combines theoretical research, practical application, and regular professional enhancement training.
Batch training	Customized teaching	
Regular training	Systematic course learning	Based on systematic learning, individualized teaching programs are implemented according to differences in teacher competence.
Weekly meetings and monthly teaching reports	Core teaching team building, weekly meetings, and monthly teaching reports	Regular meetings and debriefings build a platform for information exchange among teachers, while the quality of teaching is reinforced through comprehensive assessment.
Unscheduled teaching activities		
Regular academic reporting	Classroom management enhancement needs	Regular skills assessments and video critiques help monitor the quality of teaching and learning and point to improvements in classroom management and homework checking.
Comprehensive grade evaluation	Categorical evaluation, third-party assessment, practice teaching and learning	Combining multiple evaluation criteria and external accreditation ensures the quality of teaching and learning.
Evaluation of public lectures	Internship evaluation	The intern's educational practice is assessed through communication with the practice unit.
	Return visit to the practice unit	
Graduation concert evaluation	Feedback from employment units on comprehensive achievement evaluation	Combination of regular and final grades, combined with feedback on post-graduation employment.

3.1.3. Selective coding

A thorough examination selected a primary category from among the recognized concepts and categories during the code selection procedure. Through multiple comparison analyses, this key category, which ended up serving as the study's focal point, showcased its integrative strength and the extensive theoretical scope of its findings. The 7 dimensions, talent development objectives, curriculum design, teacher team building, instructional materials selection, teaching and learning process management, and the assessment system, were found to be important ideas that underpinned the axial coding process and served as the foundation for a theoretical framework for talent development after a thorough analysis of the axial coding, as in Table 4.

The primary categories' relationship structure shows how the talent cultivation process's dynamic interactions interact. This framework emphasizes how crucial it is to comprehend educational practice, especially in regard to how skill cultivation goals can be met through the efficient coordination and integration of diverse components. The Table 4 illustrates these aspects' direct and bidirectional linkages, highlighting their logical sequence and interdependence in talent cultivation efforts. The dynamic interaction of talent cultivation process can be seen at Table 5.

The talent development process is a dynamic cycle that begins with defining talent development objectives to influence curriculum design. The designed curriculum is then implemented via a textbook system, which must be consistent with the program's objectives. Educational administration supports the execution and collects data for course evaluation. The evaluation results are used to fine-tune the objectives and curriculum design, resulting in a continuous cycle of progress in the talent cultivation process.

Table 4. Selection of coding

Main category	Genus	Connotation of genus
Talent development objectives	Determination and implementation of educational objectives	Determine and implement educational objectives to enhance students' comprehensive abilities and professional skills.
Curriculum design	Planning of educational content	Plan the teaching content and structure to ensure the curriculum design meets educational objectives and student needs.
Curriculum implementation	Application of teaching methods	Apply effective teaching methods and technologies to execute the curriculum plan, promoting student learning.
Teaching staff or faculty	Development and management of teachers	Build and manage a team of teachers, enhancing their professional capabilities and the quality of teaching.
Textbook usage	Selection of teaching resources	Select and utilize appropriate textbooks and teaching resources to support achieving teaching objectives.
Educational administration or instructional management	Monitoring of the teaching process	Manage teaching activities and the environment to ensure teaching quality and student engagement.
Evaluation mechanism	Evaluation of educational outcomes	Establish an effective evaluation system to assess students' learning outcomes and teaching effectiveness.

Table 5. Dynamic interaction of talent cultivation process

Typical relationship structure	Connotation of relationships
Talent development objectives → curriculum design	The objectives set for the development of human resources guide the development of the content and framework of the curriculum and ensure that the curriculum is organized in a way that is consistent with the aims of education.
Curriculum design → curriculum implementation	The designed content and framework are implemented through selected teaching and learning activities.
Curriculum implementation → textbook system	The program is implemented with appropriate teaching and learning materials and resources to ensure that the body of materials supports the teaching strategies used and the achievement of the learning objectives.
Curriculum design ↔ textbook system	There is an interaction between the curriculum and the system of teaching materials, which must be selected to match the program's objectives and content, and the program's design needs to consider the characteristics and resources of the existing teaching materials.
Curriculum implementation → educational administration	Effective curriculum implementation requires good teaching management support, including course scheduling, allocation of teaching resources, and monitoring of learning progress.
Educational administration → course evaluation	Data and feedback collected during the teaching management process are used for course evaluation to assess teaching effectiveness, student satisfaction, and the extent to which the teaching objectives have been achieved.
Course evaluation → talent development objectives	The course evaluation results are used to adjust and optimize talent development objectives to ensure continuous improvement of the educational process and achievement of academic goals.
Course evaluation ↔ curriculum design	Feedback from the course evaluation is applied to adjust and refine the course design, and these adjusted course configurations will be reassessed in the next round of the course evaluation process.

3.1.4. Theoretical saturation test

After 3 rounds of coding and analysis, 12 individuals in this study were thoroughly interviewed. It was observed that the participants' answers did not present new ideas not found in previous interviews, suggesting that the study has reached theoretical saturation. The "Xindi Applied Piano Pedagogy" study proposes a 3-phase system to preparing music teachers in primary and secondary schools. The first phase establishes a solid basis through curriculum preparation, team formation, topic planning, and efficient resource utilization. The second phase increases the main course, introduces minor programs, and improves teacher preparation in response to curriculum reform challenges. The last step evaluates teaching efficacy, tailors the curriculum to varied student needs, and enhances the course assessment and teaching management systems.

3.2. Results of training models

3.2.1. Training modes

The "Xindi Applied Piano Pedagogy" is a collaborative endeavor between Xinghai Conservatory of Music, Guangzhou Chengjian Vocational College, Waterfront Primary School, and research institutions. These institutions collaborate to improve the teacher training process in learning, production, and research. This approach has resulted in a comprehensive piano curriculum that combines pedagogy, music theory, and practical applications, fostering innovative teaching approaches and professional development for instructors, as in Figure 1. The program has enhanced teaching materials, increased learning opportunities, and improved music instruction, establishing a standard for future implementation.

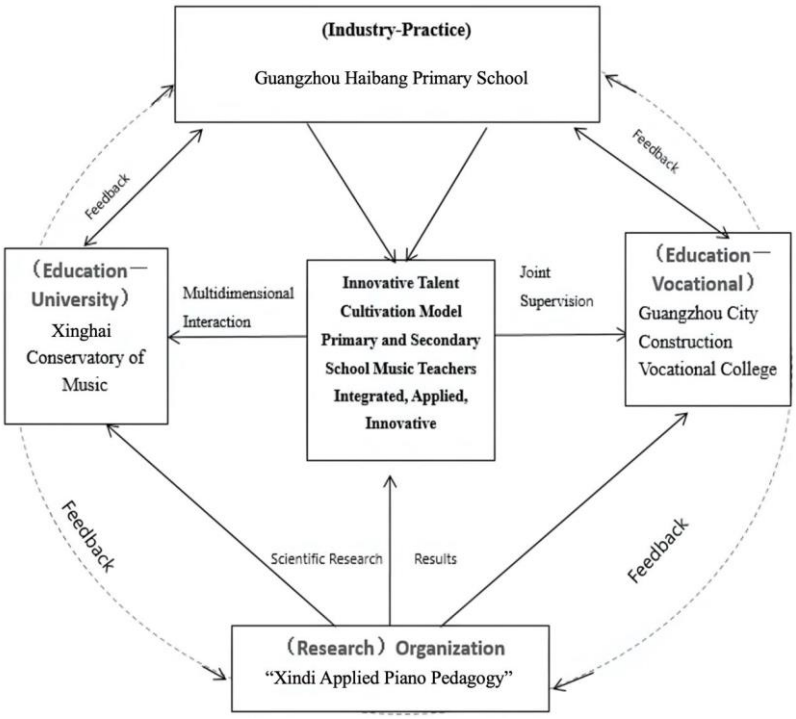

Figure 1. "Xindi Applied Piano Pedagogy" model of training mechanisms for music education in primary and secondary schools

The "Xindi Applied Piano Pedagogy", based on grounded theory, effortlessly blends theory and practice, allowing students to apply theoretical knowledge to music composition and performance while improving their overall, creative, and practical skills. Students use university-industry-research cooperation to demonstrate their skills on multiple platforms, contribute to social services, and extend music services. This approach stresses holistic development and tailored education, which promotes student achievement. However, problems such as differing training objectives, various student skills, and huge class sizes impede classroom management and teaching balance. While instructional tools exist, limitations in instructors' knowledge and abilities limit their practical application, forcing changes to optimize the collaborative mechanism and improve educational quality and efficacy.

3.2.2. Elaboration model

A plan, do, check, act (PDCA) cycle is incorporated into the "Xindi Applied Piano Pedagogy" for training music teachers in elementary and high schools [29], [30] to maximize the quality of instruction. The process consists of the following steps: i) planning, which combines resources from universities, research centers, and industry to create creative programs; ii) implementation, which carries out the plan, applies creative strategies, and strengthens industry cooperation; iii) checking, which assesses the efficacy of educational activities using feedback mechanisms; and iv) action, which makes the necessary adjustments based on the information gathered, as in Figure 2. This does not change anything: the procedure ensures high quality and continuous improvement while enabling effective and durable system of music teacher preparation, as well as productive collaboration between research institutions, universities, and businesses. It stresses the importance of modern teaching innovation, as well as the role of effective management dynamics on the efficacy of talent development systems.

The Figure 2 depicts a dynamic, cyclical model of talent training that begins with the 'industry' sector, which establishes objectives and develops curriculum. This plan is then sent to the 'research' section for work on the syllabus and training of lecturers. Then, the 'academia' sector practically undertakes the implementation and evaluation of the textbooks through academic activities. This its efficacy is compared to the benchmarks set by industry where the industry also cycles back into the system. This continuous loop sustains a skillful harmonized system. This is very important feedback throughout the system showing the need for all the sectors to work together illustrates the collaboration between industry and academia to curriculum development and the role education plays on advancing industry and the innovations through educated research scientists.

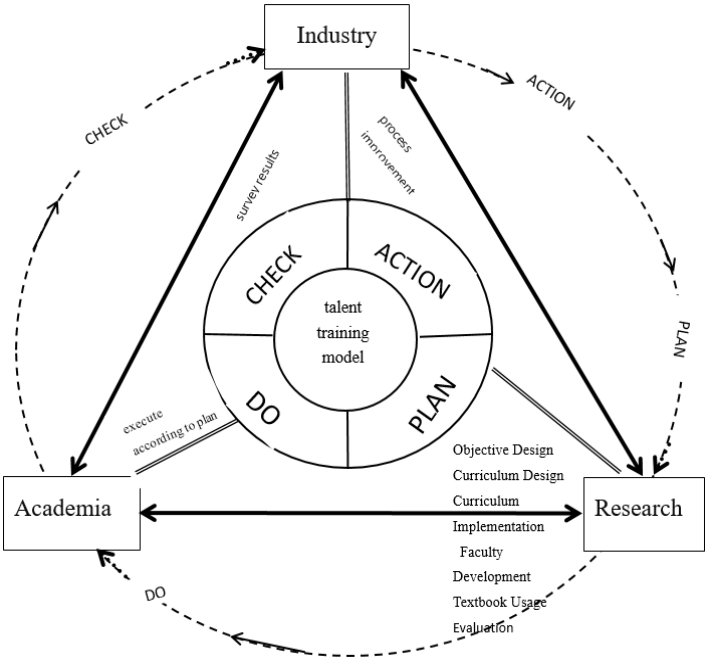

Figure 2. Talent cultivation mode under industry-university-research cooperation

3.3. Discussion

This study examined the technical components of "Xindi Applied Piano Pedagogy" and its model of training pathway for music educators. Prior work has missed these links in a performer's preparation: technical skill, emotional expression, cultural components, and their integration into music training. We found that a three-phase method enhances curriculum structuring, course offerings, and teacher development with more active participation through partnerships between universities, industry, and research organizations. This method, derived from the Triple Helix theory, sustains interaction among research, education, and business for the creation and expansion of ideas and their application in practice for innovation in music education.

The Triple Helix theory offers an unmatched approach for nurturing innovative talent, citing the need for interaction between research, education, and business as a foundation [31]–[34]. As demonstrated by "Xindi Applied Piano Pedagogy" [35], [36]. This method fosters sustainable development of creative education in music and talent development, which is non-linear and cross-collaborative. This approach results from synergy of research institutions, educational organizations, and business aims to equip prospective teachers of music at primary and junior secondary levels. It fuses the imaginative approaches of the applied research centers, the educational research conducted at the universities, and the sector-specific systems to design an advanced environment that fosters talent development [37], [38]. This research has noted that "Xindi Applied Piano Pedagogy" combines teaching music with sociology and economics, and simultaneously challenges dominant narratives regarding education and socioeconomic development. It promotes an agile, systematic integrated framework for talent cultivation. It advocates for an agile, interconnected system of a talent development framework that responds to the rapid changes in the economic and social development needs [1], [39], [40].

Although "Xindi Applied Piano Pedagogy" and the Triple Helix theory provide a comprehensive approach to talent development, they have shortcomings. An overemphasis on collaboration among the research, academic, and industrial spheres may overlook the needs of students and teachers. In addition, how effective the four-step PDCA quality management cycle is regarding its claimed efficiency in actual scenarios is yet to be established. There is a need to focus more on how these theories can be adapted to other educational levels and disciplines. In addition, the consequences of these methods on the real-world practices of music teaching professionals need to be studied more closely. Finally, how well the model enables the creation, in real time, of a fluid, integrated talent development system in volatile situations needs further analysis.

4. CONCLUSION

With regard to the findings, it is evident that "Xindi Applied Piano Pedagogy" is executed in 3 primary methodological phases: reflection, practice, and theory. The first phase centers on the building of essential core infrastructure components, such as curriculum, teaching models, and school staff customized to various music

educator proficiency levels. The second phase focuses on Advanced training with emphasis on teacher improvement through specialized programs and rigorous teacher training for teaching staff. The final step includes reflective practice and programmatic curricular responsiveness to evolving student demands, dynamic growth through defined value frameworks such as cumulative performance evaluations and constructive feedback. This method, guided by the Triple Helix theory, outlines a systematic way of envisioning training pathways built on collaboration between research institutions, educational organizations, and schools. Novel teaching strategies are supplied by research institutions, comprehensive training is provided at colleges through integration of music theory, piano skills, pedagogy, and practicing teaching at elementary schools is done through shared teaching practicum environments. The result is music educators who possess contemporary instruction and development in primary and secondary school holistic competencies that are practical, innovative, and comprehensive.

Our research indicates that tailoring teaching methods to fit students' differing needs is a vital part of effective teaching and education. The "Xindi Applied Piano Pedagogy" study highlights this with a recommendation to improve curriculum and course offer, as well as amplify teacher training through triadic synergistic revolving schema. This interdisciplinary approach promotes collaboration between universities, industries, and research institutes, yielding enhanced educational instruction and more aligned pedagogical frameworks. This case 12 management is designed to respond to students' needs and requirements. Such example includes the ease of creating accompaniments or other forms of playing during singing which serves multiple different levels and styles of learners. This also asks for rethinking an adaptable flexible responsive talent development ecosystem, which is foundational to ensuring education operates within current realities in an ever-evolving world.

This research looked into applying the Triple Helix theory of fostering creative talents in music education using "Xindi Applied Piano Pedagogy" as a case study. The focus is on the collaboration of the university, research, and industry, forming an ecosystem for the innovative development of talent and resources. "Xindi Applied Piano Pedagogy" enhances training through a PDCA cycle which fosters educational quality and collaboration. This research is scoped within a qualitative paradigm; however, more explorations are needed to validate the designed trials and interventions within this triad in classroom scenarios.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Lanqing Ye	✓							✓	✓					
Yaoping Liu		✓						✓	✓	✓		✓		
Wannaporn Siripala	✓			✓					✓	✓				
Tassanee Laknapichonchat						✓				✓				
Yudhi Arifani				✓	✓					✓				

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
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Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare there is no conflict of interest.

INFORMED CONSENT

All information collected in this study will be kept confidential, and all participants' identities will not be revealed in any reports or publications. Participations are entirely voluntary. They may withdraw at any time without penalty or impact on their role in the school. By agreeing to participate, they acknowledge that they understand the study's purpose, procedures, and their rights as research participants.

ETHICAL APPROVAL

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) Rajamangala University of Technology Krunthep Thailand (25.7.5/UTK32.14/PB/2025) for studies involving humans.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [WS], upon reasonable request.

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APPENDIX

Table 2. Open coding

Original interview data (initial concepts)	Category
X1: Developing integrated students challenged by the refinement of instructional objectives and varying degrees of piano skills.	Music teacher training objectives Teaching objective setting
X2: Emphasis on instructional design and management, with varying levels of goal achievement due to student skill differences.	Individualized teaching Differences in competence
X3: Focus on skills such as improvisation and accompaniment but lack specific educational goals and assessment mechanisms.	Refinement of objectives Teaching design
X5: Clearly defined individual teaching goals, but student ability differences limit extension. X6: Existence of musical aesthetics and creative pedagogical skills, lack of clear educational planning. X8: Teaching objectives are vaguely stated and lack specific assessment criteria.	Lack of assessment mechanisms, clear planning, skills development
X1: Customized piano teaching with a varied curriculum adapted to the student's ability.	Teaching diversity programme, personalized teaching, teacher professional development
X2: Piano teaching is practical, with extended lesson time recommended and practice emphasized throughout the education period.	Customized teaching, practical emphasis, curriculum continuity
X5: Standardized curriculum aimed at students of the same level but with little practical content.	Skills application Systemic deficits, subject linkages
X7: Emphasis on popular music playing, improving practical skills, lack of systematization, and linkage of subjects.	

Table 2. Open coding (continue)

Original interview data (initial concepts)	Category
X2: Digital Piano group lessons with 5 integrated teaching positions, playing to double piano mode. X4: Individualized, one-to-one planning for piano teaching, facing the challenge of students at different levels. X6: Combination of playing and strumming instruction, adapting to students of different levels, implementing the 5-position but ability-limited approach. X8: Adaptation of the curriculum for weak students, starting with children's songs. X10: Group applied piano lessons, diversified forms of teaching. X1: Comprehensive student development, with refined goals, facing skill differences. X2: Emphasis on instructional design and application of skills, with varying degrees of goal attainment. X3: Strong improvisation and accompaniment ability but lacks detailed objectives and assessment. X5: Clear teaching objectives, but differences in students' abilities limit extended learning. X6: Musical aesthetics and compositional skills exist, but clear planning is lacking. X8: Teaching objectives are vague and lack assessment criteria.	Digital piano group lesson teaching, 5-position integration Personalized one-to-one lesson planning, Skill differences Basic teaching Diversified teaching forms Comprehensive training Instructional design Improvisation
X1: The textbook contains 13 modules for piano learners of different ages and skills, emphasizing application, variety, and mutual support between modules. X3: A series of materials are used, including strumming, harmony, and piano transposition, as well as improvisation and accompaniment, to distinguish between large classes and one-on-one instruction. X5: The choice of materials is based on the semester curriculum and the specific situation of the students in the class. X9: Uniformity in using teaching materials and planning of all lessons according to the uniform level of the pupils entering the school. X10: The quality education program for primary schools uses the "Tutorials for playing and singing ancient poems on the Xindi Applied Piano" and the "Quick Tutorials, " aligned with the industry-academia research project.	Modular materials, application, diversity, mutual support of teaching, large classes, and one-to-one Adaptability of courses Unified curriculum planning Quality education Industry-academia-research interface
X2: Establishment of a teaching and research department for industry-academia research projects, full-time faculty building, and occasional course training. X3: Customized Teaching after the systematic course of study, biased teacher competence, diverse teaching styles. X5: Comprehensive course of study, application limitations, few qualified teachers, facing cognitive limitations and resistance. X7: Training courses in batches, high teacher mobility, difficulty for new teachers to follow up teaching. X9: Regular training and teaching and research activities to advance teaching progress and improve the quality of teaching and training. X10: Teachers are trained through the program and then appointed to teach, emphasizing the importance of training for teacher qualification.	Industry-academia research faculty, full-time faculty, course training Systematic learning, teaching customization, competence bias, diverse teaching methods Application limitations, teacher certification Mobility issues Regular training and research activities Teaching quality improvement
X1: Weekly meetings, monthly teaching reports, building a core teaching team, and comprehensive assessment of teachers. X2: Irregular class listening, teaching and research, exhibition and skill competitions, lack of daily communication, and unification of teaching methods. X3: Weekly skills assessment, video review, and learning are needed to improve classroom management and homework checking. X6: Regular learning reports, classroom video supervision, lack of uniformity in content of teaching methods. X8: Encourage participation in skills competitions to validate training effectiveness.	Weekly meetings, monthly reports, core team building Comprehensive assessment, teaching and research activities, skills competitions, lack of daily communication Skills assessment, video review, classroom management Learning report, teaching supervision, method content inconsistency Competition validation
X1: Classification evaluation, third-party assessment, practice teaching activities, professional accreditation services. X2: Evaluation of the educational practice of interns and return visits to practice units. X3: Irrational evaluation mechanism affecting teaching implementation and motivation. X4: Combination of usual and final grades, graduates' employment feedback. X6: Graduation concert, employer observation and recruitment, corporate recognition. X7: Symposiums and questionnaires, feedback on students' skills improvement. X9: Students develop a curriculum according to the needs of primary school music classrooms. X10: Diversified programs for arts festivals and student performances. X11: Open class for music teaching and research, demonstrating the integration of ancient poems and music. X12: Teaching and learning open class, evaluation of performance, presentation of the results of the arts festival.	Classification evaluation, third-party assessment, practice teaching Professional accreditation, educational practice evaluation, and assessment mechanism Combination of grades, employment feedback Graduation concert, employer observation Enterprise recognition, skill improvement Curriculum development Diversified programs, art festivals, public lectures, teaching and research demonstrations, integration of ancient poems and poems, teaching exhibitions

BIOGRAPHIES OF AUTHORS

Lanqing Ye currently enrolled as a Doctoral candidate at the esteemed Department of Education and Society, within the Institute of Science Innovation and Culture at Rajamangala University of Technology Krungthep, Thailand, has dedicated his academic pursuits to the field of education. Her research interests are deeply rooted in the contemporary landscape of educational research, with a specific focus on the critical analysis and innovative development of teaching curricula. In addition to his current doctoral studies, she has a strong academic background, having completed his Master's degree at the same prestigious institution, where he distinguished himself by achieving high academic honors. For further academic discourse, collaborations, or inquiries related to his research. She can be contacted at email: 669240200040@mail.rmutk.ac.th.

Yaoping Liu a distinguished senior lecturer, holds the esteemed position of director at the Institute of Science Innovation and Culture (ISIC) at Rajamangala University of Technology Krungthep. The university is conveniently located at 2 Nang Linchi Road, 10120 Bangkok, Thailand. Over the course of his illustrious career, he has dedicated himself to the comprehensive study of Buddhism. His scholarly pursuits encompass a broad spectrum, from the intricate philosophy underpinning Buddhism to its profound teachings and their subsequent development over time. In addition to his work in Buddhist studies, he has demonstrated a keen interest in the evolution of management strategies and pedagogical models in today's rapidly changing era. For further academic inquiries related to his research. He can be contacted at email: yaoping.l@mail.rmutk.ac.th.

Wanaporn Siripala a distinguished senior lecturer at the Department of Education and Society within the Institute of Science Innovation and Culture at Rajamangala University of Technology Krungthep, Thailand, has dedicated her academic career to addressing contemporary educational issues. Her scholarly pursuits have led her to develop a profound interest in the systems and models that underpin educational development. In particular, she has shown a keen interest in the integration of technology into learning environments. She recognizes the transformative potential of technology in reshaping pedagogical practices and enhancing student learning outcomes. Her work in this area reflects a deep understanding of the need for adaptability and innovation in modern educational practices. For further academic collaborations related to her research. She can be contacted at email: wannaporn.s@mail.rmutk.ac.th.

Tassanee Laknapichonchat a distinguished senior lecturer at the Department of Education and Society within the Institute of Science Innovation and Culture at Rajamangala University of Technology Krungthep, Thailand, has dedicated her academic career to addressing foreign language learningl issues. Her scholarly pursuits have led her to develop a profound interest in the teacher professional development. She recognizes the utilization of technology in reshaping pedagogical teacher education practices. Her work in this area reflects a deep understanding of the need for adaptability and innovation in teacher education. She can be contacted at email: tassanee.l@mail.rmutk.ac.th.

Yudhi Arifani a distinguished senior lecturer in the Department of Education and Society within the Institute of Science Innovation and Culture. He has dedicated his academic career to the advancement of English language learning for English as a foreign language (EFL) students across all levels. His commitment to this field is evident in his innovative approaches to curriculum development and pedagogical strategies. His research interests cover CALL teacher professional development. He can be contacted at email: yudhi.a@mail.rmutk.ac.th.