A COMPARATIVE STUDY OF TEACHING PIANO TUNING AT XINGHAI CONSERVATORY OF MUSIC, GUANGDONG PROVINCE, THE PEOPLE'S REPUBLIC OF CHINA

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Abstract

The research topic was "A Comparative Study of Teaching Piano Tuning at Xinghai Conservatory of Music, Guangdong Province, The People's Republic of China" The purpose of the study was to find out the advantages and disadvantages of commonly used piano tuning software, specifically: (1) the professional piano tuning software and (2) the advantages and disadvantages of the different visual tuning software. The methodology was mixed-method research: This research is qualitative and quantitative. Research tools: Interview Form, Questionnaire Form, Observation Form. Population and sample: This study consisted of 356 students from Xinghai Conservatory of Music, Guangdong Literary & Art Vocational College, and Guangdong Dance and Drama College in Guangdong Province, China. A sample of 60 students was selected using purposive sampling, with 50% of the total students from each of the three schools participating in a sample survey.

The research findings were: (1) In interviews with professionals, it was generally found that the use of piano tuning software was supported as a means to enhance student's learning efficiency in piano tuning lessons. All 12 experts reported using Yamaha PT-A1 and Tunelab, along with other piano tuning software. Specifically, 8 experts utilized Verituner, while 6 experts preferred TLA CTS-5-C. Despite experimenting with other tuning software, satisfactory

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results were not achieved. The survey results indicate that Yamaha PT-A1, Tunelab, Verituner, Reyburn Cyber Tuner, and TLA CTS-5-C are the most commonly utilized professional tuning software options. (2) The data analysis of questionnaires completed by 12 teachers and 60 students reveals the following findings: PT-A1 is the most commonly used software for piano tuning teaching, while TuneLab has lower accuracy but a superior overpull mode. However, Cybertuner and Verituner software have complex interfaces, are expensive, and have limited availability, leading to low usage rates among respondents. TLA CTS-5-C is primarily used in manufacturing and lacks versatility for teaching and testing. Each software has its unique features, so the choice depends on specific needs. For advanced features, Verituner is recommended, while PT-A1 is better for simplicity and quick results. TLA CTS-5-C can provide accurate tuning but is limited. Careful consideration of software features is advised.

Keywords: Piano tuning; Tuning software; Advantages; Disadvantages

Introduction

Piano tuning involves adjusting the tension of strings to achieve harmonious sound by slightly turning the tuning pins. This process follows acoustical laws and aesthetic customs to ensure each string is in harmony with others (Phillips, 2017). Tuning a piano is a complex task that requires adjusting every note using the twelve-tone equal temperament. It also involves fine-tuning the piano's internal mechanical movements for optimal performance (Chen, 2014). Early piano tuners faced challenges due to non-standardized pitches and a variety of piano models (Berg & Stork, 2005).

The process of tuning a piano requires careful listening, comparing pitches, and adjusting string tension to eliminate beats (Reblitz, 2019). Traditional teaching methods rely on aural judgment, but beginners often struggle due to their limited ability to hear and understand the abstract concepts (Jin, 2018). Developing the necessary skills, such as identifying beats and setting tuning pins accurately, is a challenging and time-consuming process (Steve, 2014). Auditory tuning is not merely a physical phenomenon; it also has physiological implications, affecting the perception of dissonance.

Visual tuning, accomplished through electronic instruments or software, offers improved efficiency and effectiveness, especially in noisy environments (Cui, 2019; Liu & Jin, 2014). Modern approaches combine traditional techniques with tuning software to enhance students' aural skills and facilitate the learning process (Steve, 2014). Inharmonicity, the shift in partials, is a consideration in real pianos and is addressed using mathematical models (Van Den Doel, 2013).

Intonation testing software plays a vital role in teaching tuning techniques, and a survey was conducted to analyze the use of visual tuning software in universities. The most commonly used software options, including Yamaha PT-A1, Tunelab, Verituner, and TLA CTS-5-C, were compared based on their functions, providing valuable insights for teaching tuning.

Research Objectives

1. Identify common visual piano tuning software.
2. Evaluate the advantages and disadvantages of different visual tuning software.

Literature Reviews

Piano Tuning: The history of piano tuning dates back to the introduction of the piano in Europe, with the profession becoming recognized around the beginning of the 19th century. The British Piano Tuning Association, Japanese Piano Tuning Association, American Piano Tuning Guild, and International Tuners Guild were founded in the 1900s and 1970s. In China, piano tuning developed later, with the first piano factory established in 1890. Training initially followed a master-apprentice approach, but the Shenyang Conservatory of Music opened a course on piano tuning in the 1970s, leading to the discipline's development in China. Today, several professional institutions in China offer piano tuning courses. (Chen, 2006)

Piano tuning methods include both aural tuning and the use of tuning software. Skilled tuners rely on their sense of hearing, while tuning software such as Yamaha PT-A1, TuneLab, Verituner, and TLA CTS-5-C provides visual feedback and advanced capabilities for accurate and precise tunings. The

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software can be installed on computers or mobile devices and utilizes built-in microphones for tuning.

Piano tuning teaching: Piano tuning is a complex task that requires not only tuning the piano correctly but also adjusting the mechanical parts. Traditional teaching relied on the master's experience and hand-holding, taking several years of practice before becoming a qualified tuner. Proficiency in controlling the tuning wrench and identifying homophonic tones began with rigorous training of the tuner's sense of hearing. In the beginning, students have difficulty grasping the change speed of the beat of the interval and circularly sealing the split law. As a result, students often do not grasp the concept of intonation well (Reblitz, 2019).

Visualizing sound can help students define a specific image of the pitch concept, understand, and accept the knowledge they have learned quickly. The use of computer software as a teaching aid can help students grasp the lesson content more quickly and accurately. Most studies on tuning are based on the results of piano tuning software tests. The main obstacle to students' learning comes from aural judgment, the lack of apparent acuity in capturing the concept of pitch, and the inability to determine whether the tuning is accurate. Measuring piano pitch curve with ETD is one of the effective ways to improve students' skills.

Aural and psychological of the piano tuning process: The piano tuning process involves aural and psychological changes due to the different frequencies in various registers. Tuners may experience pressure and impatience, affecting their auditory sensitivity. Students learning to tune may also be affected by fatigue. Depressed individuals may experience reduced auditory acuity and a tendency towards nervousness and anxiety during tuning. Prolonged exposure to loud sounds can lead to sensorineural hearing loss. Musicians have a range of tolerance for subjective perception and judgement of pitch, which may differ from objective measurements.

Relevant research: Academic research on piano tuning in China has mainly relied on practical techniques, with recent research focused on using visual tuning software to improve teaching and accuracy. Several studies have highlighted the benefits of using tuning software, including the ability to acquire technical knowledge visually, quickly and accurately, and to achieve teaching

objectives. Combining visual and aural tuning can complement traditional methods and improve pitch perception, accuracy, and intuition. TuneLab and PT-A1 are popular software choices, with TuneLab offering great accuracy and the ability to adjust the scale as inharmonicity changes. Verituner is recommended for smaller upright pianos with design flaws. ETDs are prevalent and used by the majority of technicians, and can help them work more efficiently with less strain. With the growing demand for good piano tuners, there is a need for institutions to train individuals in this skill.

Research Methodology

The research will be conducted at Xinghai Conservatory of Music in Guangdong, China. The sample size will consist of 12 piano tuning teachers and 60 students. The research will involve interviews with the teachers to gather information about their commonly used visual tuning software. Additionally, a questionnaire will be administered to the students and teachers to gain insights into their experiences and perceptions of visual tuning software.

Results

The study aimed to investigate the advantages and disadvantages of commonly used piano tuning software, specifically focusing on professional piano tuning software and different visual tuning software. The research utilized both qualitative and quantitative methods to gather data and analyze the results.

Professional Piano Tuning Software: Interview results: During qualitative interviews with 12 teachers, common problems in piano tuning teaching were identified, including students' difficulty in understanding the concept of "beat" and lack of practical skills. To address these issues, experts recommended the use of tuning software to help students experience different sound zones and improve their practical skills. Other challenges highlighted were maintaining stable pitch, lack of interest in learning, misreading or unclear judgment in the bass range, difficulty in discerning different tones, uneven pace of learning, and overuse of fingers resulting in fatigue and muscle damage.

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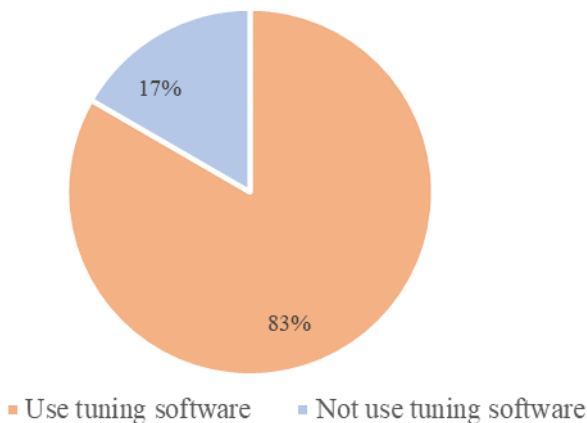**Experts suggest using piano tuning software**

Figure 1: The proportion of 12 experts interviewed who suggested using piano tuning software.

To address these issues in piano tuning lessons, the experts suggest incorporating piano tuning software. After convening a focus group meeting with the experts, 10 out of the 12 experts supported the use of piano tuning software, while 2 opposed it. As shown in Figure 1, the percentage of experts recommending the use of piano tuning software is high.

According to the results of an interview with 12 experts, the use of piano tuning software was generally supported as a means to improve students' learning efficiency in piano tuning lessons. The majority of the experts (12 out of 12) reported using Yamaha PT-A1 and Tunelab, as well as other piano tuning software. Of these, 8 experts utilized Verituner and 6 experts used TLA CTS-5-C. Although they had also tried other tuning software, they did not achieve satisfactory results. The survey results reveal that Yamaha PT-A1, Tunelab, Verituner, Reyburn Cyber Tuner, and TLA CTS-5-C are the most commonly used professional tuning software. 。

Conclusion from professionals: Based on the interviews, the majority of experts emphasized that the main teaching problem in piano tuning is students' unclear understanding of the concept of "beat." A smaller group attributed the problem to students' lack of practical skills, while others identified factors such as a lack of motivation to learn.
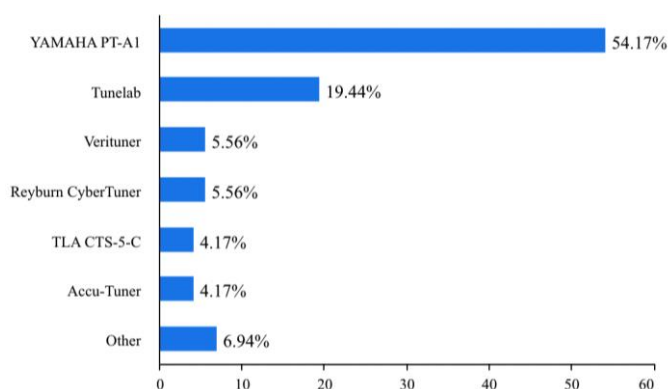
Reliability and validity

Cronbach Alpha

N of Items	n	Cronbach α
14	72	0.815

Table 1:

The collected data underwent reliability analysis, and the results indicated high reliability (α coefficient > 0.8). This ensures that the data can be used for further analysis. Additionally, the validity of the data was verified through the KMO and Bartlett test, which indicated that the research data was suitable for extracting meaningful information.

Analysis of survey results

Figure 2: Survey the proportion of other visual tuning software.

The results survey of 12 teachers and 60 students show that the usage rate of Yamaha PT -A1 is 54.17%, Tunelab is 19.44%. Verituner and Reyburn Cyber Tuner at 5.56%, TLA CTS-5-C and Accu-Tuner at 4.17%, and other tuning software at 6.94%.

2. Advantages and disadvantages of different visual tuning software

2.1 The advantages of visual tuning software

Items	Categories	N	C.P.
PT-A1 is the best visual	1	6	8.33
	2	7	18.06

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tuning software because of its ease of use.	3	8	29.17
	4	5	36.11
	5	46	100
Total		72	100

Table 2: Advantages of Yamaha PT-A1

Items	Categories	N	C.P. (%)
The accuracy of TuneLab is lower than that of other ETDs, but the overpull mode is the best.	1	5	6.94
	2	4	12.5
	3	11	27.78
	4	19	54.17
	5	33	100
Total		72	100

Table 3: Advantages of TuneLab

Based on survey results from 60 students and 12 teachers, Yamaha PT-A1 emerged as the most commonly used visual piano tuning software, with a high approval rate of 63.89%. It was praised for its simplicity and ease of use compared to other software options. Tunelab was also appreciated for its overpull mode, which was considered superior to other tuning software options.

2.2 The disadvantages of visual tuning software

Items	Categories	N	C.P. (%)
The interface of Verituner and Cybertuner is more complex and difficult to master.	1	1	1.39
	2	2	4.17
	3	7	13.89
	4	2	16.67
	5	60	100
Verituner and Cybertuner is the most expensive of the ETDs.	1	2	2.78
	2	3	6.94
	3	2	9.72
	4	1	11.11
	5	64	100
The TLA CTS-5-C is	1	1	1.39
	2	2	4.17

cumbersome to use and is not suitable for teaching tests.	3	3	8.33
	4	1	9.72
	5	65	100
The TLA CTS-5-C is most often used in manufacturing production scenarios.	1	1	1.39
	2	2	4.17
	3	5	11.11
	4	4	16.67
	5	60	100
Total		72	100

Table 4: Investigation on disadvantages of Verituner and Cybertuner

In terms of price and operational performance, Cybertuner and Verituner were perceived as having complex interfaces and higher costs, resulting in lower usage rates among respondents. TLA CTS-5-C was primarily seen as suitable for manufacturing and production purposes, lacking versatility for teaching and testing. These factors led to lower adoption of these software options in the classroom setting.

Overall, the research findings suggest that incorporating piano tuning software can address common teaching problems in piano tuning, such as students' unclear understanding of the concept of "beat." Yamaha PT-A1 and Tunelab were identified as the most commonly used and preferred software options due to their functionality, practicality, and ease of use. However, software options with complex interfaces, high costs, and limited versatility were found to have lower adoption rates among teachers and students.

Discussions

With the increasing demand for precise piano intonation, there is a need for a tool that can effectively assist piano tuners in their work (Politis et al., 2015a, b). Computer software, as a teaching aid, offers the advantage of enhancing learning outcomes by providing a more direct, quick, and accurate understanding of lesson content. It employs scientific methods and encourages the exploration of new ideas, allowing it to complement traditional teaching approaches while driving the transformation of tuning instruction (Zhang, 2019). Considering these teaching tools and factors, one of the main obstacles faced by

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students is their ability to judge sound accurately, perceive pitch concepts clearly, and determine the accuracy of tuning. Addressing these challenges is a common concern in education. One effective method for improving students' skills is to measure the piano's pitch curve using Electronic Tuning Devices (ETD).

The aim of this study is to evaluate the advantages and disadvantages of professional piano tuning software, thereby selecting the optimal tuning software. The study will focus on the following aspects: 1) commonly used professional piano tuning software, and 2) the advantages and disadvantages of tuning software.

Discussion About the Common Piano Tuning Software: According to the interview results of 12 experts, the main reason for using piano tuning software for teaching and learning is that students do not know the concept of "beat" in piano tuning clearly and cannot hear and distinguish the pitch changes of the piano clearly. In order to improve students' learning efficiency in the learning process, more and more colleges and universities adopt ETDs as teaching tools, which can not only improve students' judgment ability, but also use professional piano tuning software to compare the tuning results with the standard pitch curve, effectively improving students' ability.

Porter, J (2017) pointed out that the piano technicians interviewed tune and prepare pianos for performances in concert halls and venues in their respective locations. The respondents live and work in 22 countries worldwide. They were asked if they use ETD's for concert tuning, with the following result: the use of ETD's accounts for 78% and the use of aural 22%. In the study for which the author interviewed 12 experts, the percentage of those who used tuning software was 83%, and the percentage of those who did not use tuning software was 17%, which is consistent.

In addition, the study by (Porter, 2017) on the use of professional piano tuning software stated that technicians need to know how to tune properly and how to achieve this through ears and machines. According to the research of (Mattingly, 2012), tuning software can help students realize the combination of hands, ears, and eyes through additional training. By combining visual and auditory voicing, it can complement the traditional way, especially in the aspects of pitch perception, accuracy, and intuition. Based on interviews with 12

experts, the author finds out which professional piano tuning software is most commonly used. Using professional piano tuning software can help piano technicians work and learn more effectively, while reducing their physical stress, especially the fatigue caused by their ears. And points out that the most commonly used professional piano tuning software is Yamaha pt-a1, Tunelab, Cybertuner, Verituner, T L A C T S-5-C. Of which, Yamaha pt-a1 accounts for 54.17% and Tunelab accounts for 19.44%.

Discussion About the Advantages and Disadvantages of Different Visual Tuning Software: The results of the questionnaire show that the main advantages are the use of the user interface, the purchase price and the function.

Pan Xinyang's (2020) research found that compared to other audio software, TuneLab has the advantage of being cheaper, more versatile, and can be used to point out discrepancies in sound. This is consistent with the author's findings in the questionnaire, and the researcher believes that Tunelab is best in overpull mode. The tuning modes of the other options are in second place behind the other ETDs, with 45.83% of the five tunings software.

In the use of interface, Yamaha PT-A1 has no complicated operation, simple interface, easy operation and powerful functions, so it can be used for sound score test. The operation is easy to learn even for beginners and is widely used in teaching. Cybertuner has powerful functions, but the operation is complicated, hard to learn and expensive. It has the function of an annual subscription. It can only be used after the subscription expires and costs up to $80 per year. For students, this is undoubtedly a high price. The research results show that this is one of the major shortcomings, which is why few people choose this software to learn and use.

As for the price advantage, the survey results show that 88.89% of the respondents think that the most expensive professional piano tuning software is cybertuner and verituner. At the same time, nearly 63.89% of respondents think that yamaha pt-a1 is the best professional piano tuning software, and choose yamaha pt-a1 and tunelab as their preferred tuning software because they think that they will be used for a lifetime after purchase. This is in line with Song Dan's (2016) research on thematic pitch recognition software in piano tuning lessons. He believes that the Yamaha PT-A1 test is widely used and that combining the measured data with tuning results for analysis and reflection can

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effectively improve listening levels, strengthen problem assessment and analysis skills, and deepen understanding of basic content. It is a teaching tool used in many colleges and universities. The author uses Yamaha PT-A1 to correct and improve his listening and judgment ability, and to strengthen the analysis of problems and results in combination with his theoretical knowledge.

The survey results indicate that 83.33% and 88.89% of the respondents believe that Verituner and Cybertuner have powerful functions and display more information, but they are not suitable for teaching and beginners, due to the requirement to master the basic technical operation to use other functions and the high cost which may be prohibitive for many students. Of the respondents, 48.83% found TuneLab's overpull mode to be the most useful function. According to research by Ma (2012), TuneLab's unique advantage compared to other professional instruments is its ability to randomly measure the "pitch curve" and "over-extension pattern" of each instrument. The author's investigation found that TuneLab's overpull mode is particularly favored by many researchers. The author believes this to be the software's biggest advantage, and it is what many avid practitioners are interested in the most. The primary reason for using it is to attain and maintain good intonation and stability, while saving effort, time, and energy.

New Knowledges

It was found that the interface of Cybertuner and Verituner piano tuning software is more complex and difficult to use compared to other options, and it is also expensive and only available in limited areas. Table 19 shows that despite being able to observe tone changes during tuning, these factors have led to a low usage rate among respondents, with 83.33% finding the software's interface too complicated to master and 88.89% considering it too expensive. As a result, these software options are not commonly used for teaching purposes. The data suggests that TLA CTS-5-C may not be the best choice for educators and students looking to use piano tuning software in the classroom.

It is an important to note that each software has its own unique features and functions, so the choice of the best piano tuning software ultimately depends on the user's specific needs and preferences. For instance, if cost is not a major concern and the user is looking for advanced features like Aural Quality Tuning,

Verituner would be a good option. However, if the user is looking for a simple and easy-to-use software that provides quick results, PT-A1 would be a better choice.

Conclusions

This study aimed to investigate commonly used professional piano tuning software and compare their advantages and disadvantages. Qualitative research was conducted through literature review and in-depth interviews with 12 experts, while quantitative research was carried out by preparing a questionnaire to collect data from 12 teachers and 60 students. The survey revealed that hearing impairment was a common problem in piano tuning teaching, and visual piano tuning software was recommended to support teaching. The most commonly used software was Yamaha PT-A1 and Tunelab, with PT-A1 being simple to use and easy to master, while Tunelab had an overpull mode for rough tuning and was cheaper. Overall, the advantages of the software outweighed the disadvantages, making them the best choice for many piano tuning students.

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