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A comprehensive study of the effects of spatial design on performance anxiety and psychological development in piano education in a family housing setting

Guo Qiu[1,*]
[1] Sichuan Conservatory of Music, Chengdu, Sichuan, 610021, China
Corresponding authors: (e-mail: qiuqiuboshi@163.com).

Abstract This paper starts from the spatial design of piano education in the family housing environment, and analyzes its impact on performers' performance anxiety and psychological development. The mechanism of the piano education space design on anxiety is analyzed, and through the design of acoustic environment, visual atmosphere, spatial layout, detailed elements, and multimedia environment, efforts are made to alleviate performers' performance anxiety and promote their psychological health development. The results showed that the psychological anxiety of the performers in the experimental group decreased from (4.79±0.9) to (2.95±0.7), and the cognitive anxiety decreased from (4.06±1.02) to (2.39±0.5), which were both significant decreases. Meanwhile, self-confidence by scores and concentration time both increased to (4.42±0.65) and (40.78±6.25), respectively, and mood shortened to (3.54±1.13) seconds. It is concluded that scientific piano education space design in family housing environment not only helps to alleviate and improve performers' anxiety, but also effectively enhances their self-confidence and concentration, and promotes the development of psychological health.

Index Terms family housing environment, piano education, space design, performance anxiety, psychological development

I. Introduction

In recent years, with the development of the economy, the national economy has also improved significantly, and performers, as the hope of national development, have been widely disseminated and strongly supported in the cultivation of their musical art. Piano education is an important program for the cultivation of music and art, and many performers begin to receive piano education before school age [1], [2]. On the one hand, parents cultivate their children's artistic hobbies through piano education. On the other hand, parents also pave the way for future art exams through art teaching, thus making out-of-school piano teaching training institutions more and more common. The teaching space of training institutions is mainly based on family housing, and in order to strengthen the effect of piano teaching, the space of piano education in the family housing environment will be scientifically designed, such as acoustic environment design, visual atmosphere, and spatial layout design, etc. [3], [4].

Anxiety usually refers to the restlessness and agitation of people for things that are about to happen or are predicted to happen, and if they are in anxiety for a long time, it will seriously affect their physical and mental health, and even lead to mental diseases. Performers in the process of piano performance will be unskilled in the repertoire, too much attention to the evaluation results, the pressure of the environment, the interference of the surrounding audience and other factors, resulting in anxiety, which seriously affects the effect of the course can be the level of performance [5]. In order to improve the anxiety of performers in the process of performance, improve the teaching effect and performers' ability to perform, this paper starts from the scientific design of the space of piano education in the family housing environment, through the changes of environment, vision and layout, to create a relaxing atmosphere in the classroom, to improve the comfort and concentration of the performers, and to improve the anxiety of performers, thus laying a solid foundation for the healthy development of the performers' psychology in the piano education. This will lay a solid foundation for the healthy development of performers' psychology in piano education.

II. Psychological influences on anxiety

A piano education institution using random interviews, a total of 50 piano performers who contacted the institution more than 6 times a month, statistics on the psychological causes of anxiety, performers in the process of piano performance anxiety, piano performance anxiety psychological causes as shown in Table 1. In the piano education

classroom 32% of the performers indicated that the irrational design of the educational space leads to anxiety psychology, so the scientific design of the educational space is an important link in determining whether the performers have anxiety psychology in the performance process. If the educational space environment is not scientifically designed, it will make the performer in the course of performance to produce irritability, restlessness, inability to focus on the emotions, which triggers anxiety [6]. In the educational space soundproof wall has a crucial role, because the educational institution is in the family housing environment, the surrounding environment is more complex, so there will be a variety of noisy sound, if the space is not installed soundproof wall, soundproof carpet soundproof equipment, will not be able to block the noise into the educational space, affecting the effect of classroom teaching at the same time, the performer can not focus on the learning of knowledge. The light of the educational space also has a certain effect on the anxiety of the performer, soft natural light will make the performer's mood naturally relax, while the darker light space will increase the performer's sense of depression [7]. Some luminous, sharp, and saturated ornaments will also increase the performers' restlessness and agitation, and increase anxiety.

Table 1: Unreasonable design of educational space

Causes of anxiety	Occupancy rate/%
Introverted and afraid to face the audience	11
Knowledge is not understood and there is no interest	11
Not familiar with the piece, afraid to perform	9
Lack of after-class practice and fear of performing	16
The teacher is too serious and oppressive	11
The teacher is too serious and oppressive	10
Unreasonable design of educational space	32

III. Spatial design for piano education in the family housing environment

III. A. Acoustic environment design

Sound insulation is an important factor in the design of piano education space in a family housing environment, which not only ensures that the sound of the piano will not be transmitted outward, affecting the daily rest of the surrounding occupants, but also reduces the entry of external sound sources, which can affect the learning of the performers, and reduces the external interference of the space to promote the concentration of the performers and enhance the sense of immersion. In addition to soundproofing treatment should also be acoustic treatment of the wall to ensure the smoothness of the piano sound, therefore, this chapter will take soundproofing and acoustic measures to complete the acoustic environment design in the piano education space [8].

III. A. 1) Acoustic treatment

In order to prevent sound leakage in the space from interfering with residents' lives and outside sources of students from entering the space and interfering with the teaching of the course, soundproof mats can be used on the floor to prevent the sound of walking from affecting the residents downstairs. Soundproof felt is attached to the roof of the shed to prevent sound from leaking out of the roof and hardening the residents upstairs. Use soundproof boards attached to the four walls of the space to organize the sound leakage. As the thinnest position in the piano education space, the window is most likely to leak indoor sound or introduce outdoor sound, so it is necessary to replace the original ordinary window glass with insulating glass with an overall thickness of 2.5cm, to create a completely closed piano education space, to prevent sound leakage and interference, and to reduce the psychological pressure of the performers who are afraid of interrupting the lives of the residents.

III. A. 2) Acoustic optimization

As the space for piano education is generally in the family housing environment, the size of the space makes the internal sound have a certain degree of emptiness or dullness. In order to promote the balance of sound in the space, you can set up local sound-absorbing panels and sound diffusion panels on the walls of the space, lay thick carpets on the floor, and hang thicker curtains on the windows, which can not only reduce the emptiness of the sound, but also improve the dullness of the sound, and improve the quality of the sound. At the same time, through the space design to improve the fun, reduce the performers because of the harsh sound triggered anxiety.

III. B. Visual Atmosphere Design

The comfort of the piano education space depends greatly on the visual atmosphere in the space, and the color, light, materials and other factors in the space will affect the visual atmosphere of the space, so this chapter will

address the color and light, materials and decorations of the piano education space for the transformation, to create a piano education space with a visual atmosphere [9].

III. B. 1) Color and Light

In order to improve the visual comfort of the performers in the space, the color scheme in the space is mainly light, such as beige, light blue, original wood and other colors, which are soft and not sharp, and will not bring a sense of oppression to the performers. The color of the roof can be set to light green or light blue, so as to enhance the breadth of the space, and once you look up, you can see the light green of the young grass or the light blue of the blue sky, which will increase the sense of relaxation and pleasure of the performers in the classroom. In order to increase the sense of indoor light, the piano can be placed near the window position, and add a number of soft light electronic light source, natural light during the day to increase the brightness of the room, and at night when the natural light is insufficient, through the electric light source to supplement the light, to avoid the gray space to the performer's sense of oppression, resulting in anxiety.

III. B. 2) Materials and Decoration

Some of the materials and decorations in the space are required to have a soft sense, so the floor, curtains and carpet material selection have certain requirements, the floor can choose the original wood-colored frosted surface flooring, curtains choose light-colored, pure cotton and linen, heavy materials, carpet selection of natural non-metallic luster of the material. It can be seen that the materials used in the space to avoid metal, reflective, hard materials, in order to reduce the sense of space oppression. In order to improve the fun of the space and increase the artistic atmosphere, a small number of set in the wall of the famous pianist photos, or piano performance process and celebrity photos, reduce the performers of the education space of the strangeness of the performers to guide the performers to study seriously.

III. C. Space layout design

Piano education is a kind of course with both openness and privacy, so in the design of the piano education space layout, we should take into account this characteristic of piano education, which can help the performer to build a private creation space to avoid the anxiety of being surrounded by spectators, and also help the performer to build an open-ended performance space, to realize the classroom test of piano performance [10].

III. C. 1) Layout that combines privacy and openness

For more introverted performers, the piano education space should preferably be a separate room with soundproof doors, which can be opened when open space is desired. If it is not possible to realize the independent piano space, the piano can be placed in the public area, in the piano perimeter 2m to set the height of about 0.7m enclosure, forming a kind of seemingly open but hidden space, reduce the anxiety of the performer.

III. C. 2) Ergonomic design

When placing the piano, the piano should not be placed against the wall, and the piano should not be placed in a narrow space, the piano should be set at a distance of at least 70cm from the peripheral wall, so as to facilitate the performers to move around near the piano, and there is no sense of oppression in the narrow space. The height of the piano is also required to meet the height of the performer to sit down after the raised arms can be parallel to the piano keyboard. If the performer needs to play in the public area, the piano should not be parallel or perpendicular to the audience, but should be inclined at an angle of 45° with the audience, and the distance from the audience should be at least 1.8m, so as to reduce the anxiety of the performer to be scrutinized positively.

III. D. Elemental detailing

The performer's sense of belonging to the piano education space is often realized through personal objects, and the sudden increase of the audience during the piano performance can also cause discomfort and anxiety in the performer's mind. Therefore, it is necessary to personalize the setting for the performer and gradually practice openness.

III. D. 1) Personalization elements

Performers can bring a small number of personal belongings into the piano education space, and when the performer is performing at the piano, the items placed next to the piano will add to the performer's sense of belonging as well as a sense of control of the space. Some green plants, for example, can also add life to the teaching space, giving the performer a sense of vitality and guiding the performer to relax.

III. D. 2) Progressive exposure exercises

Many performers may because of introversion, repertoire is not familiar or belong to the practice, made unable to confidently perform in front of the audience, so you can set up a mirror in front of the performer's performance, the performer in the performance through the mirror can be self-observation. After a period of performance practice, it is appropriate to add one or two audiences, and then after a period of contact, it can add two or three audiences, with the increase in performance practice time, the audience behind the performer is more and more, the performer also began to slowly adapt to the environment of the open-ended performances, which will help to improve the performer's uneasiness and introverted character, and to reduce the anxiety of the mind. Monitoring can be installed in the space, so that when the performer finishes the performance, video playback can be performed to check the movements and expressions that are not in place during the performance, as well as the mistakes made during the playing, in order to improve the performer's performance level, and to promote the gradual transformation of the performer's anxiety into his or her concentration on the performance.

III. E. Multimedia environment design

The design of the piano education space can not be separated from the installation of multimedia equipment, teachers in the explanation of knowledge, but also need to guide the performer through the multimedia video playback for the in-depth understanding of knowledge. It is also possible to build a growth wall in the space, where photos of different stages can be pasted on the wall to enhance the performer's sense of achievement. Based on this, this chapter will complete the design of the multimedia environment from the aspects of multimedia equipment and growth wall.

III. E. 1) Multimedia equipment

Multimedia equipment can assist the piano education process, including some famous repertoire, are required to play the pianist's live performance video, to promote the performer to the pianist live performance performance emulation, improve the performer's performance level. Another example is the camera in the space, which can help the performer to view the performance playback and realize the performer's self-improvement.

III. E. 2) Growing Wall Setup

A growth wall is set up in the space, where photos of the performers at each stage are posted on the wall, and photos of the performers at each competition or with celebrities can be posted on the growth wall, which not only reminds the performers of the need for continuous self-improvement, but also lets the performers feel their own growth, builds up self-confidence in them, and gradually removes their anxieties.

IV. Research design and analysis of results

IV. A. Experimental design

A piano education institution was used as the research object, 15 people were randomly selected as the experimental group and the remaining 15 as the control group, and both groups of performers were given piano teaching for 6 months. The daily piano teaching of the performers in the experimental group was carried out in the environment of the completed piano teaching space design, and the daily piano teaching of the performers in the control group was carried out in the environment of an ordinary family house, and the performance anxiety and psychological development of the performers in the two groups were compared and analyzed after the 6-month piano teaching. SPSS 11.0 software was used to process the data, and all data were expressed as (x±s), t-test was used, and $P<0.05$ was regarded as statistically significant difference.

Pre-tests were administered to the performers in both groups by means of the Performance Anxiety Scale and the Psychological Assessment Scale, and descriptive statistics of the pre-test results are shown in Table 2. The results showed that there was no statistically significant difference between the groups in the pre-test results of performance anxiety and rational development, $P>0.05$.

Table 2: Descriptive statistics of pre-test results (x ± s)

Group	Performance Anxiety in Children	Child Psychological Development
Experimental group (n=15)	28.62±3.19	37.31±4.03
Control group (n=15)	27.94±3.11	36.79±3.94
t value	3.76	3.95
P value	>0.05	>0.05

IV. B. Comparison of performance anxiety between groups

Performance anxiety was measured for the two groups of performers who underwent 6 months of piano teaching, and the performance anxiety of the two groups was scored by the Child Performance Anxiety Scale, and the performance anxiety ratios are shown in Table 3. The results showed that the experimental group showed a significant decrease in psychological anxiety from (4.79±0.9) to (2.95±0.7), cognitive anxiety from (4.06±1.02) to (2.39±0.5), and behavioral avoidance from (2.82±0.6) to (0.93±0.4) after 6 months of piano teaching. While the post-test values of the performers in the control group decreased very little compared to the pre-test values, it can be seen that the performance anxiety results of the experimental group were significantly better than those of the control group, and that the design of the piano teaching space in the family housing environment can significantly alleviate the performance anxiety of the performers.

Table 3: Comparison of performance anxiety (x ± s)

Anxiety symptoms	Anxiety performance test	Experimental group (n=15)		Control group (n=15)	
		Pre-test	Post-test	Pre-test	Post-test
Physiological Anxiety	Increased heart rate, shaking hands and feet, sweating on palms and back during piano performance	4.79±0.9	2.95±0.7	4.77±0.8	4.32±0.6
Cognitive Anxiety	I always think I will play wrong or perform poorly.	4.06±1.02	2.39±0.5	4.11±0.9	3.79±0.7
Behavioral avoidance	Refusing to perform in front of family or other audiences	2.82±0.6	0.93±0.4	2.80±0.5	2.04±06

IV. C. Psychological development between groups

The two groups of performers who underwent 6 months of piano teaching were compared in terms of psychological development evaluation, and the psychological development of the two groups was scored by the psychological development evaluation scale, and the comparative analysis of the psychological development evaluation is shown in Table 4. The results showed that the experimental group, after 6 months of piano teaching, self-confidence increased from the score of (2.67±0.81) to (4.42±0.65), concentration time increased from (24.36±4.92) to (40.78±6.25) minutes, and the time taken for emotional regulation decreased from (8.73±1.92) to (3.54±1.13) seconds. There was a significant improvement in the psychological development of the performers in the experimental group after practicing in the educational space. In contrast, the performers in the control group showed little effect on self-confidence, concentration, and emotion regulation, indicating that the design of piano teaching space in the family housing environment can effectively promote the psychological health development of the performers.

Table 4: Comparative analysis of psychological development evaluation (x ± s)

Anxiety symptoms	Anxiety performance test	Experimental group (n=15)		Control group (n=15)	
		Pre-test	Post-test	Pre-test	Post-test
Self-confidence	Willing to perform piano for the audience/evaluate 1~5 points	2.67±0.81	4.42±0.65	2.65±0.79	3.14±0.53
Concentration	Average piano practice time/minute	24.36±4.92	40.78±6.25	23.99±4.85	27.31±5.23
Emotion Regulation	Wrong emotion adjustment time in piano performance/second	8.73±1.92	3.54±1.13	8.61±1.87	7.76±1.64

V. Conclusion

This paper accomplishes the design of a piano education space in a family housing environment, aiming to alleviate the anxiety of performers' piano performances and to promote the performers' psychological health. By designing the ascending environment, visual divided into, spatial layout, elemental aggregate and multimedia environment, it creates a relaxing piano performance space in terms of sound insulation, color as well as ergonomics. A piano education institution was used as the research object, and was randomly divided into experimental and control groups. The daily piano teaching of performers in the experimental group was carried out in an environment where the design of the piano teaching space was completed, and the daily piano teaching of performers in the control group was carried out in an ordinary family housing environment. The results showed that after 6 months of piano teaching, the performers in the experimental group had significantly lower anxiety and were significantly improved. In addition, in terms of psychological development evaluation, the self-confidence score of the performers in the experimental group increased to (4.42±0.65) points, and the time taken for emotion regulation decreased from (8.73±1.92) seconds to (3.54±1.13) seconds. The design of piano education spaces in family housing environments not only relieves anxiety, but is also a key way to promote the development of mental health.

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