Designing Craft Learning Experience for Rural Children: A Case Study on Huayao Cross-Stitch in Southwest China

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Abstract. Craft is characterized by tacit knowledge, which is featured as embodiment and contextualization. In the circumstances that the rural craft learning socio-cultural context have already changed significantly, this paper tries to probe the issue that how to capture those characteristics of craft knowledge and transfer them successfully into an attractive craft learning experience for rural children.

Taking Huayao cross-stitch–an ethic minority Intangible Cultural Heritage in southwest rural China as a case study, the paper regards digital game as a mediated method to arouse the craft learning interest of rural children and facilitate their understanding of craft knowledge. Focusing the acquisition and presentation of craft "Know-How" knowledge in craft, aiming at promoting the learner's reflective observations in learning experience, this paper proposes a game-based craft learning experience design model and verifies the model with a Huayao Cross-Stitch Game.

Keywords: Craft · Learning experience · Rural children · Digital game Skills

1 Introduction

As one of the principal modes of self-sufficient production in the pre-industrial age, rural handicrafts carry the socio-culture information of certain regions. In many rural areas of China, based on kinship and geographic, craft knowledge can be passed down from generation to generation. During this process, not only the local knowledge is reproduced, but also the learners' socio-cultural identities are shaped. With the rapid modernization, great changes have taken place on rural craft in China. On the one hand, in order to make living, many young people have to leave their villages and become migrant workers in big cities, which not only break the traditional rural craft inter-generational inheritance, but also turn their children into so called left-behind children. On the other hand, since mass production with increased access to ready-made goods, craft skills now are no longer necessary for rural everyday life. In recent years, with the growing concern about intangible cultural heritage in China, rural crafts which were once neglected, now are back into the spotlight. In some rural areas,

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local crafts are integrated into the primary curriculum with the name of "Bringing the Intangible Cultural Heritage into School".

Aiming at this kind of craft courses, usually the primary schools will invite local craft masters to teach the pupils—most of whom are left-behind children. For these young learners, however, the craft learning is neither attractive because of local craft masters' traditional teaching methods, nor is motivational in this new socio-cultural situation. Existing data and researches show that as the "digital natives", today's children are growing up in information age, who are surrounded by computers, cell phones, video games and other digital devices [1]. Even in remote rural China, there is no exception. With the improvement of mobile communication networks and the popularization of smart phones in China, now rural people can get smart phones with affordable price too. As a daily necessity, smart phones are used by left-behind children to communicate with their parents who are migrant workers. With various applications, smart phone have became the favorite toy for rural children. Prensky pointed out that as a new generation of learners, "digital natives" have different learning and cognitive characteristics from the previous generation, and the old teaching methods are no longer adapt to these new learners [2]. Moreover, it is necessary to construct a new learning and education system to deal with changes of these young learners [1].

Thus, based on the interests of these rural "digital natives", this paper tries to probe the issue that how to capture those characteristics of craft knowledge and transfer them successfully into an attractive craft learning experience for rural left-behind children.

2 Theoretical Background

Craft as an activity is based on the intellectual and physical characteristics of the maker. In crafts, a special way of knowing about the world has been formed: Knowing is directed by a vision of doing by hand and shaped by the mental and concrete products of doing [3]. Craft includes a large amount of "Know-How" content, not only so-called procedural knowledge in the cognitive psychology–the execution of single actions and entire chains of actions, or processes [4], but also those informal, difficult to expressed experiences or skills, and even those shared knowledge that must be transmitted through human interaction. In recent years, with the development of embodiment cognition, scholars interpreted characteristics of craft knowledge from the new theoretical perspective–on the one hand, it is embodied and individualized, which implies that people's intellectual cognition of this kind of practical knowledge is based on specific body structures and physical activities in a certain environment; On the other hand, craft knowledge also has the collective attributes which can be shared by a certain community. It is embedded in certain environment and social relations, that can be reproduced through the artisans community, social hierarchy and division of labor assumptions [5–7]. Coherently, so far knowledge in these areas has been transmitted mainly by observation or imitation of craft experts in real contexts—it is so called "learning by doing", or "apprenticeship". In general, the acquisition of handicraft requires long term repetitive practice, which can form the whole cognition of "insight" in the process of touching and using materials and tools [8].

Experiential learning is the process of learning through experience, and is more specifically defined as "learning through reflection on doing". Compared to rote learning or didactic learning that makes learners to learn passively, one of characteristics of experiential learning is initiative. As a "hands-on" learning, craft is undoubtedly "participatory" and "experiential". However, in the changing socio-cultural context, craft learning situation is quite different from that of traditional apprenticeship learning. Some craft education researchers have proposed that "'Hand' should include by the present technology can provide all of the hands and hearts of extensions" [3, 9]. Some scholars also pointed out that for craft education, the main challenge is to recognize current educational patterns. In order to solve the problem of all kinds of complicated situations in the future, now we should put more emphasize on how to stimulate learners' interest, promote their active participation and cooperative learning, and help them to use different tools and techniques to create new knowledge [3, 10].

In the field of digital learning design, Experiential learning theory had inspired many researchers. Prensky pointed out that digital game is not always the enemy, it can also become the effective means to provide the best learning experience for children [11]. Experiential learning theory consists of several models that stress the importance of direct experience and reflective observation. One of them that gave great inspirations to game learning designers is Kolb's four stages experiential learning model [12]. According to Kolb, the experiential learning is a continuous circle which consists four stages of goal-directed actions. The circle begins with a concrete experience; then followed by reflective observations of that experience; after that is the abstract conceptualization stage in which the learner can makes generalization; at the end of the circle, through active experimentation the learner will test these ideas in new circumstances. Based on Kolb's model, a game researcher Kristian Kiili, who comes from Finland, proposed an experiential gaming model with the combination of flow theory and game design. Kiili's model stresses the importance of providing the player with immediate feedback, clear goals and challenges that are matched to his/her skill level [13]. Both of models became the theoretical bases for this research using digital game as a mediated learning method for rural left-behind children.

In recent years, there are some efforts to use serious games to enhance the learner's learning experiences in the field of intangible cultural heritage education, such as i-Treasure project from Italy. Instead of declarative knowledge, one of main concerns of these attempts is the acquisition of procedural knowledge, then transmit these knowledge by game based learning with various cutting-edge technologies, such as AR, VR etc. As a result, the learner's motor skills were trained, together with their learning engagement and motivation are enhanced [14].

Therefore, these previous studies provide theoretical and practical basis for our research. In this paper, digital game is regarded as a mediated method to arouse the craft learning interests of rural left-behind children and facilitate their understanding process of craft knowledge. Further, how to acquisition and presentation of craft "Know-How" knowledge in games becomes the focus of this paper. In this respect, this paper initiates the case study on Huayao Cross-stitch–a national intangible cultural heritage in southwest china.

3 Research Objects and Methodology

Huayao cross-stitch is one of the unique techniques of an ethnic minority Huayao in the poor remote rural regions of southwest China. The earliest Huayao cross-stitch can be traced to Han dynasty, and in the following centuries Huayao cross-stitch technique has made considerable development. In 2006, Huayao cross-stitch was listed in the *China National Intangible Cultural Heritage Catalogue*. Because of without their own national characters, patterns made with cross-stitch on Huayao costumes become records of its ethnic history. Huayao cross-stitch differs a lot from the ordinary cross-stitch which has the same pattern on both sides, although they are both produced on warp and weft fabrics. Under the guidance of its back side up stitching, Huayao cross-stitch can create different patterns on both sides of a cotton fabric at the same time by counted thread: the front side is a pattern composed by countless "X", and the back side is made up of numerous short dash "-" (Fig. 1).

Fig. 1. Huayao cross-stitch can create different patterns on both sides of the fabric at the same time by counting thread: the front side is a pattern composed by countless 'X' (Left), and the back side are made up of numerous short dash '-' (Right).

For a long time, Huayao cross-stitch is an essential skill for local Huayao women. A cross stitch master usually will be regarded as ideal marriage partner with the characteristics of dexterity and intelligence. As a local custom, Huayao women begin to learn cross-stitch at her 8 or 10 years old. Normally, the first teacher of their cross-stitch learning is their female relatives, such as mother, sister, aunt, etc. By kinship, Huayao women can acquire this traditional skill–from the most basic cross stitches such as "X" or "-" to the most complicated patterns consist of numerous these basic units which will be used for their future life (Fig. 2). With the rapid modernization progress in Huayao villages, although the old generation keep wearing traditional Huayao costumes, the way of cross-stitch learning has changed a lot. Owing to the changing lifestyle, most of local young people are not wearing traditional clothes any more. Moreover, for making living, a large number of young people poured into cities, which turned their children into left-behind children, and broke the traditional craft transmission mechanism based on kinship as well. As a consequence, Huayao cross-stitch gradually became an intangible cultural heritage that requires to be protected. Then with the name of

"Bringing the Intangible Cultural Heritage into School", cross-stitch course entered local elementary school since 2016. In order to observe current Huayao cross-stitch teaching and learning patterns in primary school, and redesign the craft learning experience for rural left-behind children with digital games, we chose the pupils in grades 5 and 6 (aged 9–12 years old) in Baishuidong Primary School as the start learner and conducted our research.

Fig. 2. Traditional Huayao dress with pattern of tigers

The whole research consisted of two stages: the pilot study and the main study. Both stages were aimed at rural children who have not any experience on Huayao cross-stitch, no matter their gender differences. In pilot study, firstly, by interviews and questionnaires, the digital environment of conducting digital game based craft learning experience design for Huayao left-behind children were confirmed. Then, the existing teaching and learning situations in the Huayao cross-stitch course in Baishuidong primary school were observed. In the main study, aimed at the most important and difficult "Know-How" part both for cross-stitch expert and pupils, we designed a digital game as a mediated learning method, afterwards we made a set of comparison tests to observe the craft learning process and evaluate the craft learning effect of left-behind children with digital games.

In both stages, taking into account of the "one-to-many" actual teaching situation in classes, the pupils were divided into several groups which include 5 students each. In each group, for better observation, we arranged an observer to record activities of both teacher and pupils with "multiple-scan" and tabular recording, and besides, a video camera was set up to assistant the observation (Fig. 3). Multiple-scan is a sampling method for social-behavioral research on a group of children [15]. In our research, each observer was responsible for observing 5 children in his/her group. With recording tables corresponding to each child, every half a minute the observer should record the behaviors and activities of each pupil with certain order, then write down the exact time of each activity. The recording form stressed four aspects of children's craft learning–knowledge acquisition and comprehension, interaction with classmates and teachers, concentration and motivation, motor skills and attitudes (Fig. 4) [16]. Video graphic approach is an adequate method for studying craft teaching and learning, especially for

making hidden aspects of craft learning visible [17, 18]. Thus, at the end of each stage, the final work of each child (Huayao cross-stitch patch) was photographed to assess the final results in combination with their respective learning in each group [18]. In addition, each child was asked to conduct a learner's self-valuation with 5 stars at both the beginning and the end of each stage. The main concern of this evaluation included three aspects, which was Liking, Challenge, Frustration (Fig. 5).

Fig. 3. In each group, there were one observer and a video camera

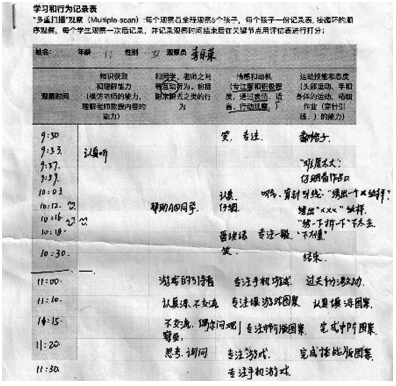


Fig. 4. A recording form stressed four aspects of children's craft learning

4.参与者自我评估：在学习活动之前和之后要求参与者进行自我感觉评估，从喜欢挑花学习的3个变量：参与，挑战和挫折，用5分制记录（儿童采用5颗星星标记）

姓名	喜欢程度	挑战指数	挫折感	备注
课前	★★★★☆	★★★★★	☆☆☆☆☆	
课后	★★★☆☆	★★★★★	★★★★★	
结束后	★★★☆☆	★★★★★	★★★★★	

Fig. 5. A recording table of learner's self-evaluation

4 Practical Work

4.1 Pilot Study

At the start of this research, a pilot study was used to confirm the possibility of experiential game-based learning in local left-behind primary school, as well as know ahead of the procedure and the current situation in Huayao cross-stitch learning class. By observing the teaching and learning procedures of craft master and pupils, we extracted the procedural knowledge of cross-stitch skill, and drew the Learner Experience Map which could help us to find out both of the pain points for pupils' cross-stitch learning and opportunities for designing a better craft learning experience

for them. Further, we proposed a game-based craft learning experience design model for these left-behind children.

Procedure

In the very beginning of pilot study, a general survey was conducted in Baishuidong primary school. By interviews and questionnaires, we visited more than 30 student's families and received 109 questionnaires from the pupil in Baishuidong primary school. Based on the data we collected, the digital environment of using digital game as a mediated craft learning method for Huayao left-behind children was confirmed. There were about 84.4% pupils had digital electronic equipment (smart phone, computer, etc.), and most of them showed great interests in digital games. In addition, according to these data, there were only 55% pupil interviewees indicated that they were willing to learn cross-stitch if only we could offer the craft learning opportunities. And in those who were unwilling to learn this craft, 75.5% of them were boys. The survey showed that it was gender that had great influence on students' learning willing of cross-stitch.

Then, aimed at pupils around 10–12 years old, a 45 min class of Huayao cross-stitch was organized. A 58 years old craft woman M, who is the Intangible Cultural Inheritor of Huyao cross-stitch acted as the teacher. There were 27 students in this class. They were divided into 5 groups by random (two groups with 6 people, others with 5). The task of this class was to teach students how to count thread, and make "X" in the front and "-" in the back of a fabric with the most basic Huayao stitching skills.

The whole teaching process included 4 stages: (1) Introduction; (2) Distribution of cross-stitch material; (3) Hands-on demonstration of key skills–counting thread and the basic stitches; (4) Practicing time for pupils. With methods of 'multiple-scan', recording forms, video graphics and learner's self-evaluation forms, we collected all the data and drew the Learner Journey Map (LJM) of Huayao cross-stitch learning (Fig. 6).

Results and Analysis

According to the LJM, in M's cross-stitch teaching class, the most unclear and frustrating part was the 3rd stage–demonstration of key skills–which was exactly the most important part of cross-stitch learning. Moreover, the final work (Huayao cross-stitch patch) of each child also showed that no more than 33.3% learners finished the cross-stitch patches correctly. And the learners' self-evaluation form indicated that compared to before class, after hands-on practices, the number of students who showed interests in cross-stitch was increased to 59.3%. Those who still dislike the craft were boys.

As an elderly craft master, M used to teach apprentice with one-by-one hands-on demonstration, and the apprentice could learn by observation or imitation. Both counting thread and doing the basic stitching on a cotton fabric are subtle skills. Although the craft master could finish a set of basic stitches in 1–2 s, actually a set of stitching procedure was complicated, which included a sequence of action: (1) stitching back up to the front side of fabric; (2) counting 5 threads along the weft in the front, (3) stitching from the front to the back side; (4) counting 5 threads along the warp, then counting 5 threads along the weft; (5) stitching back up to the front side of fabric again. What's more, a set of these stitches were happened on an area no more than 5 * 5 mm^2 (Fig. 7). As a result, to acquire these skills, the learners had to observe very closely and

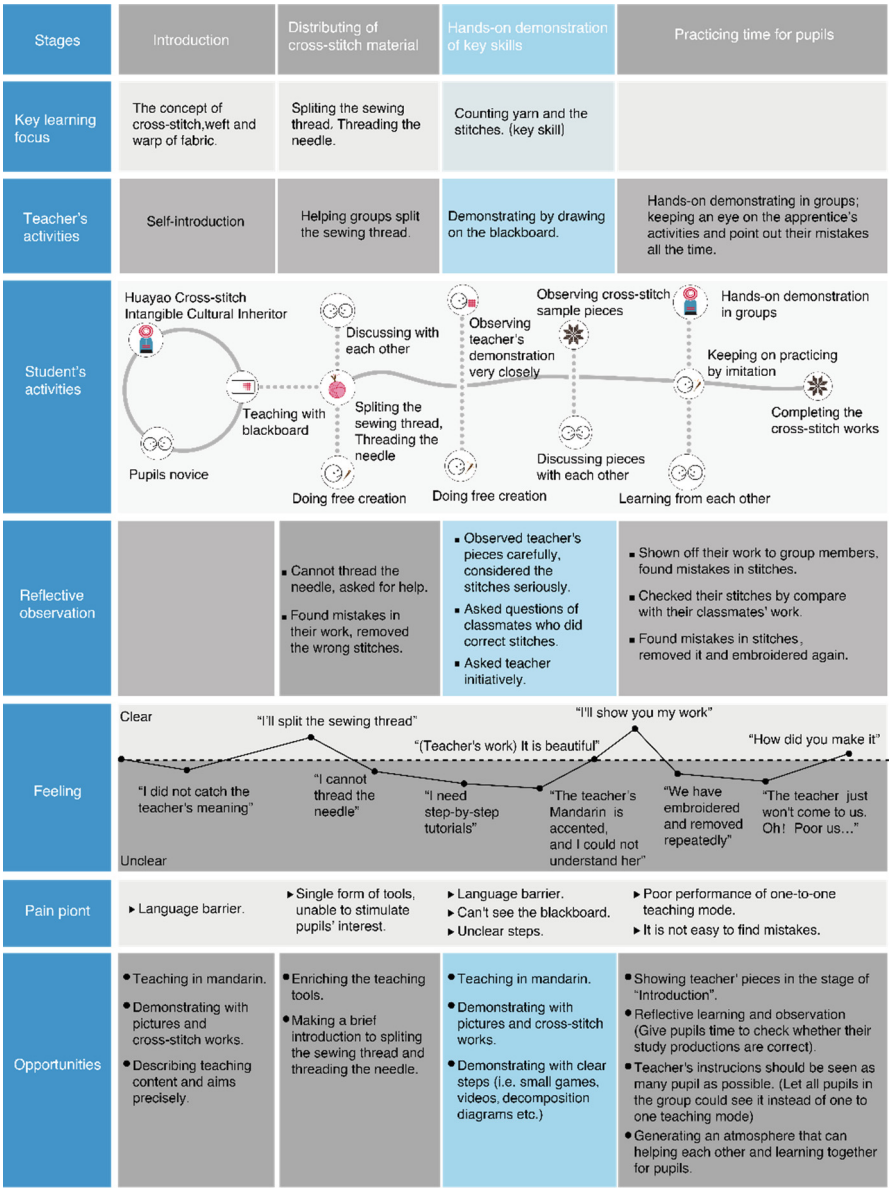


Fig. 6. Learner journey map of Huayao cross-stitch learning in Baishuidong primary school.

keep on practicing. Even though, these stitches were too fine for them to do without make any mistakes, which makes it necessary for the craft master to keep an eye on the apprentice's activities all the time. Thus, this traditional cross-stitch teaching method might work when there were only one or two students, but was not suitable for a craft class. Once the number of student went up to 5 or more, it was a little bit difficult for

the learner to capture the key point of the skill knowledge. In addition, because M could use only native Huayao language rather than mandarin, which increased the difficulties to communicate with pupils.

Fig. 7. Surrounded by pupils, M was demonstrating the key skills of counting thread and basic stitches

If we regard the whole process as an experiential learning circle, it is obvious that to get better learning experience and results in a craft class, we can make full use of all kinds of methods to promote the learner's reflective observations, such as improving key skills demonstration with illustrations, or offering immediate feedbacks when the learner do wrong or correct operation with digital games, and adding multi-media effect and reward mechanism to enhance learning interest of the learners etc. Therefore, we proposed a game-based craft learning experience design model (Fig. 8) and designed the Huayao Cross-Stitch Game based on the model.

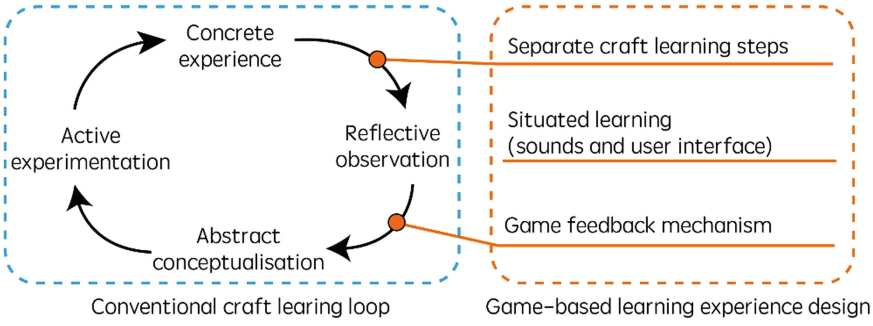


Fig. 8. Game-based craft learning experience design model.

4.2 Main Study

In main study, to verify the impact of digital game on the craft learning experience, we organized a comparative experiment. The task of both Group A and Group B was to teach students how to count thread, and make "X" in the front and "-" in the back of a fabric with the most basic Huayao stitching skill in 45 min, the same with pilot study. And both of groups included 1 teacher, 1 observer, and 5 pupils.

The differences between Group A and Group B lay in the teacher's different teaching methods. In Group A, craft learning was kept in a traditional hands-on demonstration and instructed by a 35 years old craft master H who can speak mandarin fluently and her stitch skill was as good as M. Based on the feedbacks of pilot study, this time H used graphics as teaching aid (Fig. 9). In Group B, craft learning was instructed by a cross-stitch novice 24 years old L, who did know how to stitch, but was not as masterful as H. L used several smart phones and iPad with Huayao Cross-Stitch Game as teaching aid (Fig. 10). Same as pilot study, we used multiple-scan, recording forms, video graphics and learner's self-evaluation forms to collect all the data.

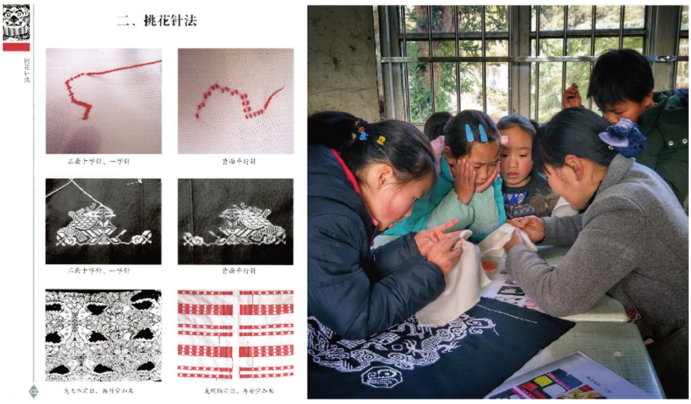


Fig. 9. H and Huayao cross-stitch teaching aid graphics in Group A

Fig. 10. L and Huayao cross-stitch teaching aid digital-game in Group B.

Procedure

Group A

Similar with the pilot study, the whole teaching process of H included 4 stages: (1) Introduction; (2) Distribution of cross-stitch material; (3) Hands-on demonstration of key skills—count thread and the basic stitches (by H); (4) Practicing time for pupils. The pupils learned skills still mainly by close observation or imitation. Moreover, with the assistance of process graphics, pupils can understand the key skills easily. H's fluent mandarin contributed a lot for communication with pupils especially in pupils' practicing time for answering their questions.

Group B

The whole teaching process of L consisted of 5 steps: (1) Introduction; (2) Distribution of cross-stitch material; (3) Hands-on demonstration of key skills—counting thread and the basic stitches; (4) Playing Huayao Cross-Stitch Game in turns (by pupils); (5) Practicing time for pupils. Compared to the teaching process of Group A, Group B added a step of playing digital-game, which attracted pupils to participate actively and promoted their reflective observations in both step 4 and step 5.

Based on the analysis on the key skills of Huayao cross-stitch in pilot study, the newly designed Huayao Cross-Stitch Game had 4 features as follows (Table 1).

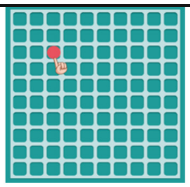
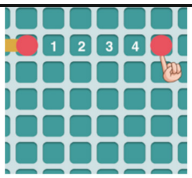
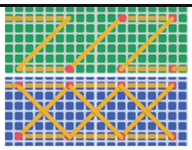
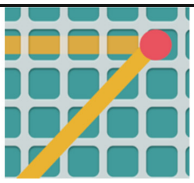
(1) Setting clear learning goals. As it mentioned before, a set of basic stitches consisted of procedure knowledge, which was a consequence of actions. In game, we divided all actions into 3 game levels. From easy to difficult, these levels were: 1. counting threads (stitching back up to the front side of fabric, then counting 5 threads along weft in front, to form "-"); 2. 45° stitch (counting 5 threads along the warp, then counting 5 threads along the weft, to form a "/"); 3. Finishing a cross stitch (counting 5 threads along the weft, then counting 5 threads along the warp, to finish a "X"). Once accomplished a level, there was a page of celebration to encourage the learner.

(2) Providing demonstration with simple animation. Cross-stitch skills were subtle, for better demonstration, we magnified the operations and represent them in a simplified, animated way. For example, the length of counting 5 threads along weft was about 5 mm on a cotton fabric, now we used grid which can represent the weft and warp and show the spatial relation of thread as well. Further, each step of the skill was animated in the game.

(3) Offering immediate feedbacks. In traditional cross-stitch learning, the instructor had to keep an eye on the apprentices in case they make mistake. It was common that the apprentice cannot find the mistake until he/she finished all the work. In game, we designed the feedback mechanism, only when learner's operation was correct, they can proceed to the next step. This immediate feedback can facilitate students' reflection behavior and improve their learning efficiency.

(4) Providing situated learning with multimedia. By adding attractive Huayao cross-stitch patterns and local music with happy rhythm, learner's learning interests were aroused.

Table 1. The improvements of game-based Huayao cross-stitch learning experience design

Pain points of traditional Huayao Cross-Stitch teaching	Huayao Cross-Stitch Game	
	Solution	Game Screenshot
Fine and subtle	Zoom in fabric Turn weft and warp of a fabric into grid on screen	
Counting thread	Use animation to show the number of threads.	
Stitches	Use Trace of lines to show different stitches.	
Stitches in the front and the back of a fabric are different	Use the grid to show the spatial relation of thread.	
Setting clear learning goals	Divide all actions into 3 game levels; Use a page of celebration to encourage the learner	

Result and Analysis

The main study data showed that there were great differences between Group A and Group B both in the learners' final works and their learning experiences.

By contrasting their final works finished in 45 min—cross-stitch patches, generally, Group A showed higher level of accuracy and completeness than Group B. There were two students in Group A who were able to complete a complete rectangle with cross-stitches, which were much more than the task required (Fig. 11). In Group B, there were only two students completed two "X" (Fig. 12). Obviously, one more step in Group B took up more time and affected the completeness of pupils' final works. And the two teachers' proficiency in cross-stitch skill effected pupils' accuracy as well.

But it is worth noting the accuracy of pupils' final works is not necessarily in accordance with their learning enthusiasms and their self-evaluation of the cross-stitch learning experience.

In Group A, with the traditional craft demonstration method, on the whole, students' learning experience were passive. In addition, H is a quiet lady and is not good at creating an active atmosphere, which also led to a serious atmosphere in class. As a consequence, after class, most of the students showed lower interests in cross-stitch than before class, and they felt more frustrated than Group B (Fig. 13).

In Group B, L is also a quiet young lady, but with the assistant of digital game, the whole learning and teaching processes were relaxed. All the students in Group B showed greater interests in cross-stitch after class. Two boys in this group even said that they were more interested in making cross-stitch than game because of the former's higher challenges (Fig. 13). Moreover, research data showed that pupils turned back to the game when they have difficulties during the practicing time. With the help of L, students could find the corresponding game levels quickly. More surprising was that instead of remembering the stitching steps, there were two boys kept in mind the patterns of stitching traces in game. They drew it down, once they felt confused in the stitch practicing, they could review these patterns (Fig. 14). Overall, digital game engaged pupils in Group B into an active learning status during the whole learning process.

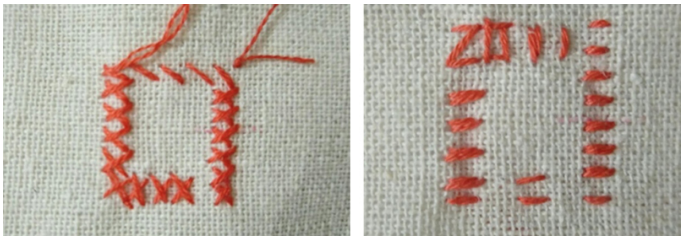


Fig. 11. A complete cross-stitch rectangle made by a pupil in group A, instructed by H.

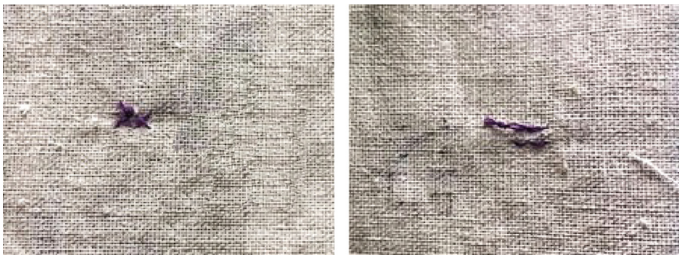


Fig. 12. Few complete cross stitches made by a pupil in group B, instructed by L and game.

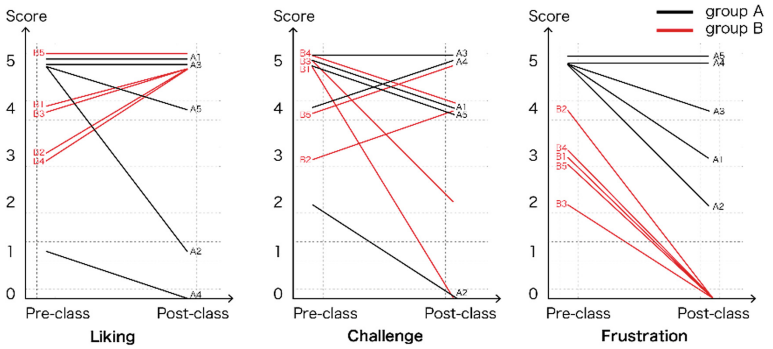


Fig. 13. The contrast analysis chart of pupils in Group A and Group B of "Liking, Challenge, Frustration," before and after the class.

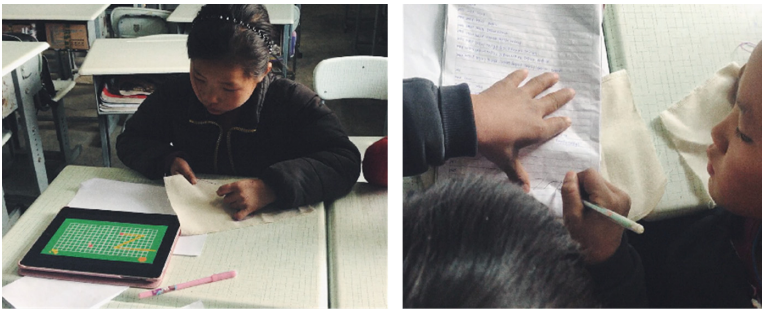


Fig. 14. The left: Pupils turned to the game when they have difficulties during the practicing time. The right: Two boys kept in mind the patterns of stitching traces in game, and draw them down.

5 Conclusion

Taking learning Huayao cross-stitch as a case study, based on the analysis of existing rural digital environment and craft learning experience, this paper regards digital game as mediated method of craft learning for rural children. Then focusing on "Know-How" knowledge in craft, this paper proposes a general model of game-based craft learning experience design. According to the model, a Huayao cross-stitch learning game for rural children was designed. Further, through observation, comparison and evaluation of rural children's digital-game mediated learning, the paper draws conclusion from the following three aspects.

Firstly, by transferring the craft procedure knowledge into digital game and using the game in the reflective observation stage of experience learning circle, it was verified in our research that digital game can significantly enhance the interest and motivation of rural children's craft learning, reduce their learning difficulties, and further facilitate them to grasp craft procedural knowledge as well. In the game-based craft experiential

learning, the traditional craft learning methods of observation and imitation can be improved greatly by a series of means normally used in games, such as clarifying the goal of craft learning, separating craft procedural knowledge and turning them into different game tasks, providing immediate trial and error feedbacks and reward mechanisms, designing learning situations with multi-channel(i.e. haptic, visual, aural) experiences that enable children to learn in a participatory manner.

However, although there are so many advantages of game-based craft learning, the paper shows that this kind of digital-games present on smart phone or other mobile devices, can only be a mediated way for craft learning, rather than replacing the learner's real hands-on making process with materials and tools.

Secondly, this paper find that during the gamification process of craft skill, because of the "knowledge gap" between craft master and designer, it is very difficult for the designer to transfer those subtle embodiment knowledges with digital game. Therefore, it is very necessary to invite skilled artisans to participate in the game design process, otherwise, there will be some mistakes that cannot be found from the perspective of designer. For example, before designed Huayao Stitch Game, designers did follow the craft expert and learn how to make Huayao cross-stitch, and represent these subtle stitches successfully in the game (see Table 1, "Counting thread"). Based on the writing habits of average people (right-handed person), the direction of the line that simulates real stitch line was designed from left to right. In fact, this design is wrong. Because in the actual cross-stitch making process, normally the one will take the fabric with her/his left hand, and with the needle in the right hand, which means that the direction of counting thread should be from right to left. Unfortunately, because of lacking embodied experiences, none of designers noticed this mistake during several times of game trial until cross-stitch expert H pointed it out when she accidentally played the game after the main study stage.

Finally, the use of digital games for craft learning can provide some opportunities for local crafts to break barriers of socio-culture tradition and be spread cross-culturally and cross-regionally. As shown in this paper, game-based craft learning attracted several boys who did not want to learn cross-stitch in the very beginning because it was seemed as a female work. In this paper, we present the general theoretical frame of game-based craft experience learning design, for further exploration, some psychology research fields such as flow, situational learning and cognitive schema should be involved in, which will be our next research themes.

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