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Article

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INFORMATION & TECHNOLOGY MANAGEMENT | RESEARCH ARTICLE

Design of digital environments to enhance handicraft co-learning experiences

Supaporn Chai-Arayalert^{1*}, Ketsaraporn Suttapong² and Surin Chumkaew²

Abstract: This research aimed to develop a digital platform that efficiently utilizes co-learning experiences between consumers and producers and to foster the preservation of local handicrafts in a manner that is both sustainable and economically feasible. This platform combines the co-design method with Kolb's experiential learning model, with a specific emphasis on improving the self-design process of local handicrafts. The research and development (R&D) methodology involves a systematic approach to addressing stakeholder needs through feedback and iteration, ensuring the final system is tailored to their specific objectives. The evaluation of the platform indicates that participants were highly satisfied with its performance. The platform facilitates extensive opportunities for collaborative participation and the exchange of knowledge, allowing participants to gain a comprehensive understanding of the processes involved in handicraft design. This research contributes to combining a virtual environment with a co-design process and Kolb's experiential learning model. The research contributes to the possibility of expansion of local crafts and the preservation of traditional workmanship, which can be achieved through collaboration between local artisans and global consumers. Encouraging consumer involvement in collaborating with the handicraft community has the potential to provide new product designs for markets, thereby boosting economies.

Subjects: Information & Communication Technology (ICT); Management of IT; Software Engineering & Systems Development; Culture; Heritage Management & Conservation;

Keywords: co-learning approach; digital platform; experiential learning; handicraft; self-design approach

1. Introduction

The COVID-19 outbreak has caused effects worldwide, and with the disease's history of high infection rates and death tolls and the risk of recurrent outbreaks, it has become a huge crisis for the world. According to the overall situation in each country, it is evident that the COVID-19 outbreak did not only affect people, but has also caused cultural changes in terms of generating new social values and behaviors and shifting them towards a new cultural phenomenon referred to as the "New Normal." In other words, it has caused shifts in the cultures and ways of life concerning things such as social distancing, work, and home-based learning. At the same time, it has initiated increases in self-adaptation and online lifestyles, along with the growth of digital technologies, and contributed to an awareness of the significance of different cultural communities in each country (Ghosal et al., 2020; Pebriantika et al., 2021; Tantrakarnapa et al., 2022).

The local handicrafts that are created by craftsmen are based on local wisdom and made with great attention to detail. The identity of Thai handicrafts reflects the craftsmen's skills and the transfer of their skills from generation to generation (Chai-Arayalert et al., 2021; Sae-Wang, 2017). Thai handicrafts also reflect the way of life in each age, telling the stories of the social and cultural backgrounds they come from (Chai-Arayalert et al., 2021; Lertcharnrit, 2020; Sae-Wang, 2017). These handicrafts possess value in and of themselves and are representative of local identities. The design of each work represents the creativity and inspiration of the craftsmen. Therefore, Thai handicrafts are the products of cultural heritage combined with the way of life, local wisdom, beliefs, traditions, and history.

The previous studies by Chai-Arayalert et al. (2021), Krasae-In (2017), Partarakis et al. (2022), Shafi et al. (2020), Suntrayuth (2017), Wondirad et al. (2022), Yang et al. (2018) found that most handicraft businesses are small and medium enterprises. Due to limited resources, they are not able to analyze marketing research and understand what products meet consumer needs. Handicrafts are developed mainly through the creativity of artisans, who are subject to manpower constraints. It can be said that the ability to create handicrafts depends on the skills and ideas of the artisans themselves and are usually produced using locally available resources. However, there is a lack of market research and methods to quickly determine consumer needs. Therefore, our study presents an opportunity to adopt innovative approaches that can help producers meet demands and consumers' insights. Co-creation, which connects consumers with producers, provides tools for product design from the outset and helps to create products that meet consumers' needs. It also improves communication between producers and consumers, enabling them to understand the different needs of handicraft products. This research fosters a continuous flow of communication between producers and consumers.

Handicraft techniques are often best learned through a hands-on approach, where learners can practice the techniques themselves. This allows them to see and understand the steps involved in creating a handicraft and to get feedback on their progress (Chai-Arayalert & Suttapong, 2020; Shafi et al., 2020; Yang et al., 2018). The co-design approach that was used in this research involved working with a group of stakeholders, such as handicraft practitioners, educators, and designers, to develop a digital platform that would support learning and value creation via self-designed handicrafts (Agbo et al., 2021; Balbi & Marasco, 2021). The platform is designed to help learners acquire the skills and knowledge they need to create handicrafts. The research found that the co-design approach was effective in overcoming the challenges of creating an engaging learning environment for self-designing handicrafts. The platform was well-received by the stakeholders, and it was found to be effective in helping learners acquire the skills and knowledge they need to create their handicrafts.

This research integrates the co-design approach and Kolb's experiential learning model, which are well suited to work properly with various digital technologies. This led to the research question, "How can digital technologies be used to enhance the experience of learning local handicrafts shared between consumers and producers?" This research aims to contribute to the handicraft design process by designing and developing a digital platform utilizing a virtual environment to enhance the co-learning experience through the integration of the co-design approach and Kolb's experiential learning model. Individuals will be able to explore their creativity, gain practical skills, present their unique works, and even transform their passion into a commercial opportunity through handicraft design. Local craftsmen can cooperate with global consumers to increase the business potential of a local craft while preserving traditional craftsmanship. Engaging consumers in the handicraft community can boost local economic growth by simultaneously designing products based on local knowledge and resources and opening up new markets.

2. Literature review

The literature review incorporates the literature on handicrafts, an experiential learning model, and the co-learning approach. These existing works will serve as valuable resources to guide the

development of innovative solutions. The research gaps identified in the field of co-learning experiences in handicrafts have prompted the creation of a novel digital platform. This proposed platform is designed to facilitate the acquisition of knowledge and skills in handicrafts through a collaborative and participatory approach known as co-design.

One kind of handicraft is hand-woven textiles, which are fabrics with fascinating and unique local patterns that are woven by hand. These fabrics originate from the body of knowledge passed down from generation to generation and cultural inheritance. Such local wisdom is an example of an intangible cultural heritage, which is transferred from generation to generation and changes with the context of each locality. It also represents the identities, cultural diversity, and creativity of the local people (Abisuga-Oyekunle & Fillis, 2016; Autthawuttikul et al., 2022; Chai-Arayalert et al., 2021). Therefore, the inheritance of knowledge from professionals is necessary to conserve local wisdom. To create local handicrafts, hand-woven textiles with unique patterns are turned into handicrafts by the craftsmanship of the locals, such that differ from industrially mass-produced products.

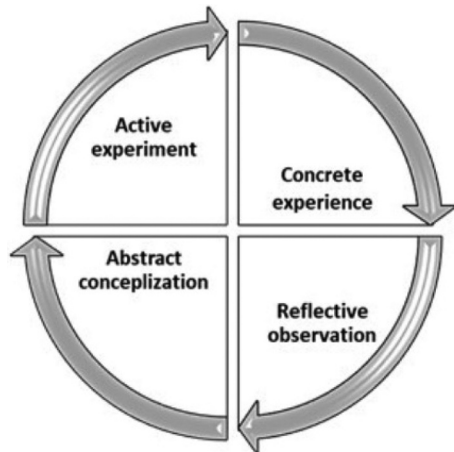
According to previous research (Abisuga-Oyekunle & Fillis, 2016; Chai-Arayalert et al., 2021; Lertcharnit, 2020; Parameswara et al., 2023; Partarakis et al., 2020; Sae-Wang, 2017; Shafi et al., 2020; Yang et al., 2018), local handicrafts are representative of traditional cultures, social, and economic value. Handicraft skills and practices are primarily transferred to family members or inhabitants of a certain locality or community, and, over time, this leads to the development of products representative of the local identity. Conservation of these handicrafts is an urgent matter because their existence is in decline as a consequence of the dwindling numbers of professionals having the requisite skills to continue their production (Abisuga-Oyekunle & Fillis, 2016; Ghosal et al., 2021; Partarakis et al., 2020; Yang et al., 2018). In the study by Chai-Arayalert et al. (2021), the dissemination of knowledge was found to be mostly a passive learning activity based on one-way communication. This means it may not be enticing for learners to participate in and they may obtain skills through a trial-and-error process of learning by doing. Moreover, the lack of learning tools makes it hard to access knowledge of handicrafts and makes it more likely that related local wisdom will be lost (Chai-Arayalert et al., 2021; Lertcharnit, 2020; Sae-Wang, 2017).

Local handicrafts are an important avenue to spread and promote Thai culture. However, there are challenges related to the need to build greater awareness of the importance of cultural heritage and its safeguarding. Therefore, being involved in this process and applying digital tools to systematically manage and conserve local knowledge is a practical action that helps support learning and create a deeper understanding.

In this project, Kolb's experiential learning model is applied to learning about designing local handicrafts with related interactions between consumers and producers. This model creates an understanding of learning styles in which learners will transform their practical experience from learning by doing into knowledge and understanding. Experiential learning refers to an experience-based learning process that focuses on actions. Learners obtain knowledge by gaining experience on their own. They then change their experience into knowledge through the learning cycle in Kolb's experiential learning model (Khrystoforova & Siemieniako, 2019; Kolb et al., 2014; Konak et al., 2014).

According to Figure 1, Kolb's Experiential Learning Cycle starts with a Concrete Experience (CE), the learning stage focusing on the perceptions and feelings experienced through the learner's sensory systems. Learners engage in activities to directly gain experience. When learners put themselves into new experiences or situations, it provides them with perceptions about the activities. The next stage is reflective observation (RO), or thinking reflectively to understand what they have observed concretely. When learners obtain new experiences, an incongruity between these novel experiences and their previous understanding may occur. A learning system creates an environment for reflection until the learner arrives at a new understanding. The third

Figure 1. Experiential learning cycle (modified from Kolb et al., 2014).



stage is abstract conceptualization (AC), where conclusions are made through a cycle of reflective observation followed by reflective thinking which continues until the thoughts become conceptualized ideas. This usually results in the creation of new concepts or the modification of existing, sometimes intangible, concepts. This means that the subjects have already learned from their experiences. Finally, the last stage is active experimentation (AE). In this stage, learners use their newly formed concepts to perform trials under different circumstances to test their concepts' accuracy (Acting). Learning does not end when new concepts are obtained, as learners will try using their thinking/concepts within other contexts to see what happens (Fromm et al., 2021; Kolb et al., 2014; Konak et al., 2014; Morris, 2020).

The co-design approach is used to create business competitiveness and innovation, in other words, to develop new products/services, or to add value to existing products/services for businesses, e.g., clothes (Threadless), watches (Idtown), or shoes (Nike). In this research, co-design was defined as procedures supporting creativity on a collective basis, whereby two or more individuals combine their ideas for product development. These procedures, in turn, become the steps involved in creating value via the active participation of the users (Sanders & Jan Stappers, 2017; Thallmaier & Möslein, 2015; Turner et al., 2020).

From the perspective of this research, the co-design approach creates mental value (hedonic value) for the participants, which is obtained through their experiences in designing their products. In other words, their participation gives rise to pleasure during the design process and pride in their work (Lember et al., 2019; Ranjan & Read, 2016). The next issue is the value of creativity as perceived through pride of authorship (Lember et al., 2019; Ranjan & Read, 2016). Additionally, this concept refers to the value arising from the ability of "learning by doing" (Kaminskiene et al., 2020; Lember et al., 2019). This research gave precedence to consumer participation in product design, which differs from traditional concepts where products are designed solely by the businesses themselves. However, to date, there have been few studies that have applied the co-design approach to collaborative learning related to local handicrafts (Kang et al., 2020; Shi et al., 2021; Thallmaier & Möslein, 2015; Turner et al., 2020).

It is believed that applying the co-design approach to create co-learning spaces using digital technologies leads to the co-creation of value until it finally evolves into a learning culture that helps learners understand and obtain new knowledge that can lead to improvements. The significance of the co-design and learning context is related to the creation of co-participation opportunities for gaining knowledge or understanding through shared experiences (Dollinger et al., 2018). The concept of the co-learning experience is implemented by preparing spaces in virtual environments that are ready for the transfer of knowledge and sharing of experiences,

which helps create the participants' knowledge (Dollinger et al., 2018). This paper presents the importance of the co-design approach and shows how digital technologies can be used to create new learning experiences to bridge the gaps between theory and practice.

In related work, Partarakis et al. (2022) proposed a web-based platform for traditional craft documentation that integrates systematic craft representation, cultural heritage standards, and advanced digitization techniques. It would enable collaborative curation of digital assets into digitally preservable craft representations to preserve traditional crafts and facilitate knowledge sharing among practitioners and researchers. The study had limitations, such as the lack of empirical data and specific examples of how the platform has been used in practice. Furthermore, Krasae-In (2017) studied how crowdsourcing can be used to develop new products for the handicraft business in Thailand. The author argues that crowdsourcing can be a valuable tool for handicraft businesses to get new ideas from consumers and develop products that are more likely to be successful. The study proposed a procedure between handicraft producers and users for co-creation. However, the author acknowledges that there are some challenges to using crowdsourcing for handicraft businesses, such as the difficulty of engaging handicraft producers in the co-creation process, the need for a large number of participants to get a representative sample of consumer needs and preferences, and the challenge of translating consumer ideas into feasible product designs. Moreover, Tung (2012) explored how designers can collaborate with local craftsmen to help local crafts reach a wider market and the ways designers can contribute to artisan communities. The author discussed how mechanization and mass production have led to the decline of traditional craftsmanship and how design interventions can help to bridge the gap between ideas and practices and revitalize traditional crafts. However, it is important to note that the study was focused on the general concept of craft-design collaborations in revitalizing local crafts and did not provide any specific case studies or empirical evidence to support the findings. Additionally, Hur and Beverley (2013) proposed a new design and production model for the fashion industry that is more sustainable. This model emphasized social engagement, knowledge sharing, and authentic product creation. The authors acknowledged that this model is still in its early stages and that further research is needed to fully understand its implications and effectiveness. They also mentioned that they were developing an online platform to support this model, but they did not provide any details about how it worked.

The previous studies, for example, Hur and Beverley (2013), Krasae-In (2017), Partarakis et al. (2022), and Tung (2012), focused on the early stages of adopting a co-design approach for handicrafts or cultural products. Furthermore, these related studies were based on theoretical frameworks or case studies; therefore, there is a need for more empirical data on their effectiveness. In addition to the limitations mentioned by Kang et al. (2020), there are a few other challenges to be addressed. Further research needs to design a collaborative environment that is easy to use and navigate; to manage the different perspectives and interests of the participants; and to ensure that the co-design process is inclusive and representative of the target audience. By addressing the mentioned challenges, this proposed digital platform would be able to meet the needs for a more effective and successful way to design and create craft products. Moreover, our research helps stakeholders understand the implications and effectiveness of integrating the co-design approach with Kolb's experiential learning model to support the co-learning experiences for designing local handicrafts, creating experiential learning, and promoting informal and life-long learning, while supporting cultural heritage conservation.

3. Methodology

The research and development (R&D) method can be applied to develop innovations and evaluate their effectiveness. This research aimed to develop a digital platform to enhance co-learning experiences through the integration of the co-design approach and Kolb's experiential learning model. The R&D method is a systematic method for developing technology, inventions, techniques, methods, or innovations. Moreover, this method has been used to develop innovations that have

undergone trials and have achieved satisfactory performance. Innovations are developed by changing or improving processes, procedures, or equipment (Mori, 2014)

This method is divided into two phases. The first phase relates to problem identification and literature review. The first step is to perform a survey of problems or needs that the project is intended to address. The next step is to conduct a literature review to gather information on the current state of the art in the field. This helps to identify the gaps in knowledge that need to be filled by the project. The second phase is the design and development of the innovation to solve the problems identified in the first phase. This begins with the research design which is the plan for how the research will be conducted. This includes the research methods that will be used, the data that will be collected, and the analyses that will be performed. The next step is to develop the solutions to the problems, which are then tested to evaluate their performance and identify any potential issues. Accordingly, this study applied these approaches to the software development life cycle which is an approach to the R&D method that involves a series of sequential steps.

3.1. Participants

The study encompassed a sample of 100 individuals, consisting of 29 males, 58 females, and 13 individuals identifying as LGBTQ+. The age range of 25 to 44 years constituted the most significant proportion of participants, accounting for 51% of the total sample. A majority (62%) of the participants reported utilizing a smartphone as their primary means of accessing the Internet. Furthermore, 88% of the participants indicated that they had been utilizing smartphones for Internet access for a period exceeding six years. None of the participants had any prior experience with customizing a product. Despite their diverse origins, all of the participants shared a common aspiration to personalize their products.

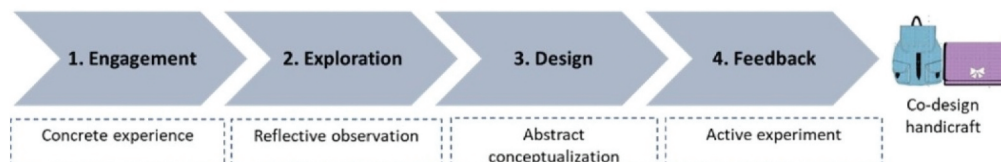
3.2. Research procedures

This research applied the phases of the software development lifecycle as follows. The first phase was performing a literature review on the co-design approach, experiential learning theories, and related digital technologies to set the system design. The second phase was data collection and requirement gathering. This study collected data from the members of the local weaving groups in Nakhon Si Thammarat Province, Thailand, and the experts on the local woven textile groups. In the third phase, the system design based on the co-design approach and Kolb's experiential learning model was developed (Kolb et al., 2014). This research gave precedence to experiences obtained by consumers and craftsmen through their co-designing products. Co-design was viewed as a tool for experiential learning and it was integrated with Kolb's experiential learning model in the system that was designed. The fourth phase was the implementation of a digital platform for co-learning experiences to enhance the design of local handicrafts. The final phase was a systematic evaluation by the end users. This evaluation was performed through online questionnaires.

3.3. System design

As noted earlier, co-design relies on the interactions and cooperation between users and designers. This entire process may be divided into a sequence of stages of interaction. The distinct stages are identified with the assumption that the learners must pass through each stage while supported by professionals (Sanders & Jan Stappers, 2017; Thallmaier & Möslein, 2015; Turner

Figure 2. System design.



et al., 2020). The following stages of interaction in the co-design process, shown in Figure 2, were implemented and are explained in the following paragraphs.

Engagement—This is in accordance with the learning style in the Concrete Experience stage of Kolb’s experiential learning cycle (Kolb et al., 2014; Morris, 2020). Learners are motivated by their interest in starting learning activities through various communication channels, which are responsive to learners (Franke & Hader, 2014; Thallmaier & Möslein, 2015; Turner et al., 2020). At this stage, a proper learning environment provides two-way communication, an internet-based learning space, communication directly between learner and lecturer, and a self-design tool. This environment needs to be created because learners have transitioned from the traditional role of being passive learners into active learners in accordance with the concepts of Kolb’s experiential learning cycle (Dollinger et al., 2018; Kolb & Kolb, 2009; Morris, 2020). Creating the proper environment can generate attraction to, and motivation for, learning. This environment must also facilitate easy access and the ability to learn from anywhere, at any time.

Exploration (Idea Development)—Learners understand what they have obtained by learning and can exhibit reflective thinking based on their own experiences. This correlates with the Reflective Observation stage of Kolb’s experiential learning cycle (Kolb et al., 2014; Morris, 2020). This is the stage where learners are motivated to search for information and synthesize it into ideas, which is a key part of learning through product development (Franke & Hader, 2014; Thallmaier & Möslein, 2015; Turner et al., 2020). When a proper environment is created for learners that support their search for information and data and allows them to combine it with their own previous experience, it facilitates their understanding and prepares them for the next stage of learning.

Design (Idea Generation)—This stage correlates with the learning as Abstract Conceptualization stage of Kolb’s experiential learning cycle (Kolb et al., 2014; Morris, 2020). Learners perform “learning by doing” with direct trial-and-error experiences by performing activities on their own. At this stage, the learners use the ideas generated in the 3rd stage to create new things, or new understandings, independently. At this point, the environment must be properly managed to promote product design (Franke & Hader, 2014; Thallmaier & Möslein, 2015; Turner et al., 2020) and create space for learners to have the freedom to design product prototypes. It could be said that this stage is trial-and-error experiential learning.

Feedback—This is congruent with the final stage of Kolb’s experiential learning cycle (Kolb et al., 2014; Morris, 2020; Piller et al., 2012) It is the stage in which learners seek out collaboration with people who are more competent or specialized in product development and communicate their product concepts to them using different methods. They then work together to improve and refine the concepts before the next stage of product development. At this stage, the proper environment for communication needs to be generated to facilitate obtaining feedback about the prototype design (Franke & Hader, 2014; Thallmaier & Möslein, 2015; Turner et al., 2020). Feedback at this stage is a key part of the co-learning experience. From a learners’ perspective, it creates an understanding of products and inspires learning and efficient knowledge sharing. From a business perspective, this can create an understanding of the consumers’ behaviors and tastes to obtain data about the actual needs for products to be in demand.

Based on the system’s design, these concepts were utilized to guide the development of a digital platform for facilitating co-learning experiences to enhance the design of local handicrafts.

4. Results

4.1. Digital platform for co-learning experiences

This research endeavored to design and develop a digital platform for co-learning experiences to enhance the designs of local handicrafts using a system that combined the capabilities of available digital technologies. The end goal of the project was to develop digital technologies for providing

learning opportunities, knowledge transfer, and publicizing information about cultural heritage related to local handicrafts in southern Thailand. The system was developed by applying the key stages depicted in Figure 2. The four stages integrated into the digital platform are based on Kolb's learning theory, the co-design experience, and the findings from user requirement gathering, as shown below.

Stage 1: Engagement—The system was designed to foster comprehension, inspire learning engagement, and accommodate the roles of active learners related to creating product designs based on locally woven textiles. This system uses communication and operational channels on a digital platform that can be accessed through the Internet using either computers or smart-phones. Thus, the system can be used anywhere, at any time, by any type of internet access device. This was needed to make it attractive, understandable, and usable for people from varied backgrounds with an interest in this topic. Thus, the project required the use of digital media that could be easily accessed for learning from anywhere, at any time. This stage of the digital platform development consisted of the project overview, designing a user-friendly interface, integrating a multimedia design, and developing the information structure.

Stage 2: Exploration—This stage provided basic knowledge about the local handicrafts, consisting of information about their history, cultural relevance, properties, production processes, and occupations related to the local woven textiles. This content was then presented using digital storytelling and learners could select what content to view based on their interests. This stage provides a basic understanding of the local handicrafts and prepares the users for learning in the next stage. An overview of this part of the system is displayed in Figure 3. The historical value related to handicrafts is displayed by explaining the history of local woven textiles in southern Thailand's Nakhon Si Thammarat province chronologically, along with the key characteristics of these textiles. The section on aesthetic value presents the equipment and tools, methods and production, and art related to the textiles. Additionally, the social value of the products is presented to demonstrate their relationship to the social, economic, occupational, and cultural aspects of the textile weaving communities.

Stage 3: Design—This stage focused on creating a learning space where knowledge and experience could be obtained through product design activities. The data on design specifications consisted of product models and decorative features, i.e., patterns, colors, and accessories. At this stage, users obtain real-world experience by creating designs. Thus, it is regarded as trial-and-error experiential learning. The users' contributions, e.g., their prototype designs, can be saved, shown, shared, and brief descriptions of them provided through the channels contained in the platform. This part of the digital platform is shown in Figure 4.

Figure 3. Overview of the digital platform for providing co-learning experiences.

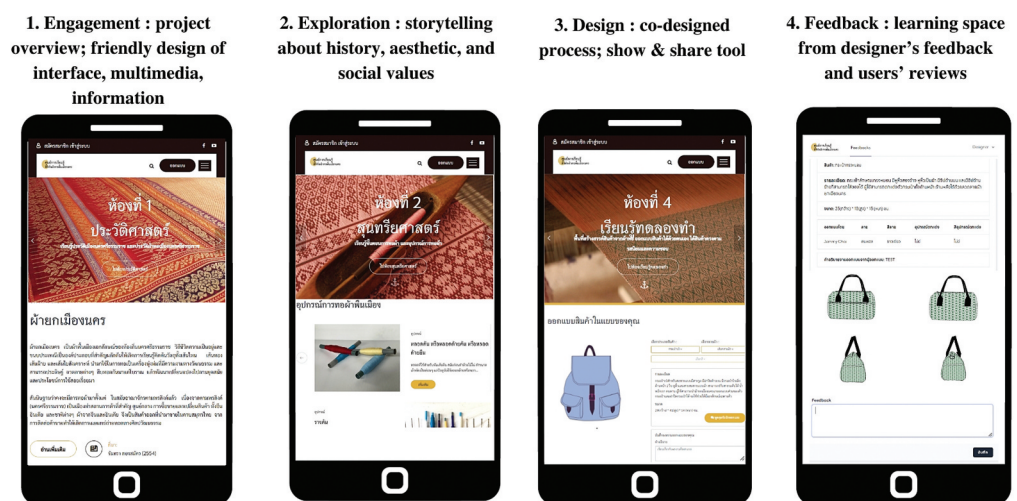


Figure 4. An overview of the system (3rd stage).



Choose product model

กระบะผ้าทรงกลม >

Choose textile pattern & Color

พื้นทอง >

ขาวเขียว >

learning content about product

กระบะผ้าลักษณะทรงกลม มีหูที่คล้องข้าง หูทำเป็นน้ำ มีzipด้านบน และมีzipด้านข้างที่สามารถใส่ของได้ ผู้ใช้สามารถตกแต่งตัวกระบะผ้าที่ด้านหน้า ด้านหลังได้ด้วยสวทลายผ้ายกเมืองนาร

ขนาด

25(กว้าง) * 18(สูง) * 15 (หนา) ซม.

[ดูตัวอย่างสินค้า](#)

บันทึกผลงานออกแบบของคุณ

Give your product information

test


Show & Share

Request feedback/ideas from experts

[บันทึก](#)

Self-design process

1. Choose product model
2. Choose textile pattern & Color
3. learning content about product
4. Give your product information
5. Show & Share
6. Request feedback/ideas from experts



Stage 4: Feedback—This stage facilitates the co-learning space for interactions between learners and professionals. In this stage, the professionals (i.e., designers) give feedback on the self-designed products in terms of suggestions and comments. During this process, users can read the advice provided by the professionals to help them reflect on what they have learned.

4.2. Evaluation

To evaluate the quality of the digital platform for co-learning experiences, we asked participants about the platform. The data collection was conducted using Google Forms. The questions were developed from the relevant research (Kaminskiene et al., 2020; Kang et al., 2020; Ranjan & Read, 2016; Shi et al., 2021; Thallmaier & Möslein, 2015; Turner et al., 2020). The questions were about usability, learning, and the self-design module. The questionnaire used a 5-point Likert scale, with responses ranging from “strongly disagree” to “strongly agree.” We computed the average scores and standard deviations for each statement for data analysis. The results showed that the overall level of user satisfaction had an average score of $\bar{x} = 4.18$. Based on the results of the evaluation, participants gave high scores to the learning context ($\bar{x} = 4.32$), App ($\bar{x} = 4.19$), and usability ($\bar{x} = 4.09$), based on the following details.

The system evaluation results regarding usability (shown in Figure 5) were at a high level of satisfaction ($\bar{x} = 4.09$). The results indicate that participants were highly satisfied with the responsive design ($\bar{x} = 4.43$), search function ($\bar{x} = 4.23$), navigation ($\bar{x} = 4.22$), system’s ease of use ($\bar{x} = 4.13$), visual layout design ($\bar{x} = 3.95$), learnability ($\bar{x} = 3.79$), and multimedia design ($\bar{x} = 3.91$) of the platform.

Regarding the learning context of local weaving textiles in Nakhon Si Thammarat Province (Figure 6), the participants expressed their overall satisfaction, with a score of $\bar{x} = 4.32$, with the individual rating results as follows: understanding the history ($\bar{x} = 4.27$), identity and value ($\bar{x} = 4.47$), and professional value ($\bar{x} = 4.40$) of local the woven textiles in Nakhon Si Thammarat Province. This system encourages participants to learn ($\bar{x} = 4.15$) and preserve ($\bar{x} = 4.32$) the local woven textiles of Nakhon Si Thammarat Province.

Regarding Figure 7, participants expressed an overall satisfaction score of $\bar{x} = 4.19$. The component ratings were as follow: Respondents indicated that the system provides

Figure 5. System evaluation: usability.

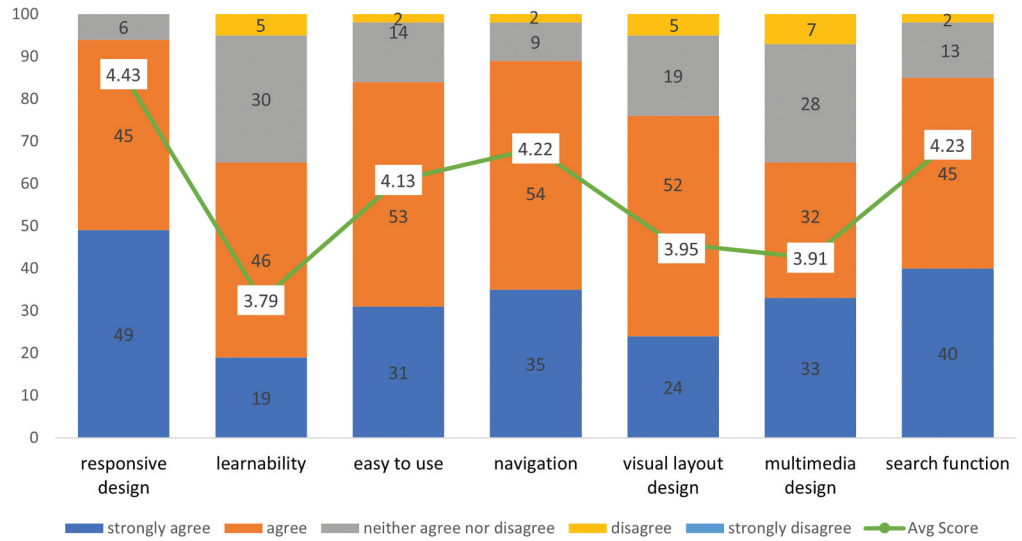


Figure 6. System evaluation: learning context.

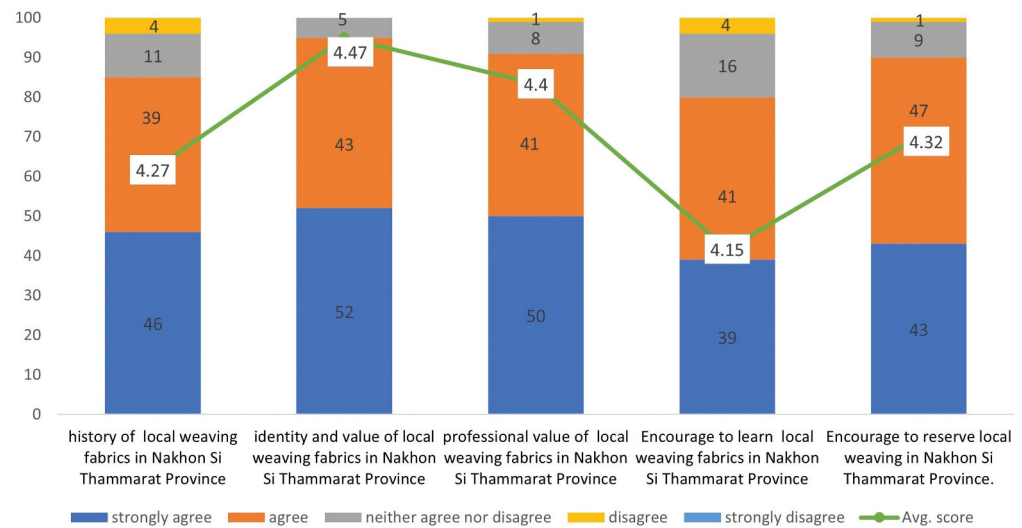
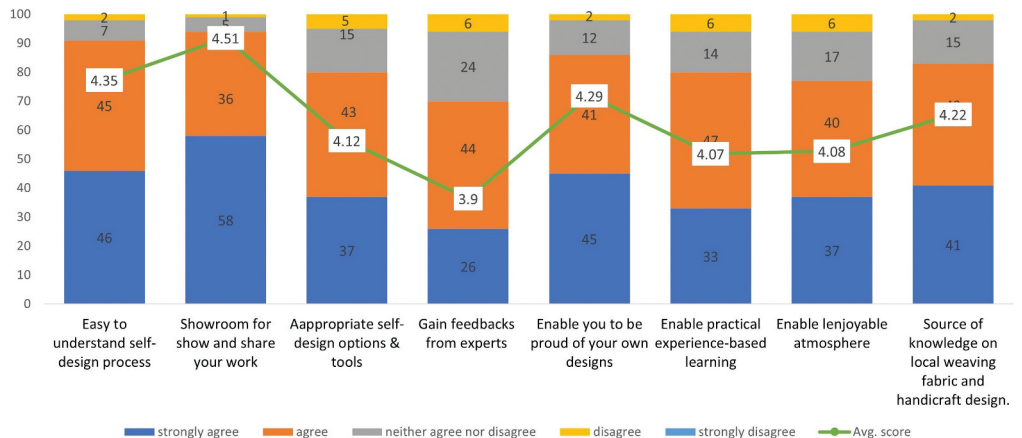


Figure 7. System evaluation: self-design module.



a showroom for showing and sharing users' ideas ($\bar{x}=4.51$), and contains appropriate self-design tools and options ($\bar{x}=4.12$). Participants also found that the system leads to understanding the self-design process ($\bar{x}=4.35$) can be utilized as a source of learning about local woven textile design ($\bar{x}=4.22$), and provides learnability through the feedback from experts ($\bar{x}=3.90$). They also opined that the system enables users to be proud of their designs ($\bar{x}=4.29$), creates an enjoyable learning atmosphere ($\bar{x}=4.08$), and enables learning by doing ($\bar{x}=4.07$).

Accordingly, the results of the usability evaluation indicate that having a responsive design makes the system accessible to a much larger audience, regardless of their device preferences, and allows users to experience the same quality of service regardless of device. Regarding the module on learning context, the results demonstrate that participants were highly satisfied with the knowledge gained from this system which will help them recognize and appreciate the identity and value of the local woven textiles in Nakhon Si Thammarat Province. According to the results of the module on self-design experience, participants were highly satisfied with this system which provides a showroom for sharing and showing ideas. Participants also referred to this system's ability to enable participants to enjoy designing and take pride in their work.

5. Discussion and conclusions

The advance of digital technology has brought about a significant transformation in consumer perspectives and access to information, facilitating the phenomenon of co-creation within the realm of handicraft design. The inclusion of a social dimension facilitates consumer engagement in the production process and provides an avenue for acquiring knowledge about artisanal items. The internet facilitates these activities' efficacy, which enables a greater number of individuals to contribute, addresses consumer demands, and fosters relationships and engagement. Current businesses are starting to change their consumer perspectives more towards a "Consumers as Prosumers" point of view (Bednarz, 2022; Rayna & Striukova, 2021). Consumers are being seen more as professionals as they transition from merely buying finished products to creating them on their own. For this reason, consumers are more frequently viewed as a source of innovative ideas by businesses. The focus of this study was the considerable challenge of how to integrate consumers as a key source of knowledge for the further development of handicrafts derived from local wisdom.

Based on the literature review, it can be concluded that co-creation in the new design process is an essential aspect of business. Previous studies have used a co-design strategy in the business and industrial sectors related to things such as new products (Khrystoforova & Siemieniako, 2019; Shaukat, 2022; Shi et al., 2021), customization (Pech & Vrchota, 2022; Turner et al., 2020), and innovation (Frow et al., 2015; Rayna & Striukova, 2021; Schäper et al., 2023), but only a few studies were discovered that explored the handicraft sectors (Hur & Beverly, 2013; Krasae-In, 2017; Tung, 2012). Tung (2012) discusses the importance of collaborating with local craftspeople to expand market potential and revive traditional craftsmanship; however, this article focuses on handicraft design cooperation for revitalizing local handicrafts without providing empirical evidence to support these findings. Krasae-In (2017) demonstrated the potential of co-creation and participation in the design process for handicraft producers, but the limitations of that study include the producers' awareness and understanding of knowledge acquisition. Hur & Beverly (2011) proposed a craft-based design and production model. However, they focused on the early stages of adopting co-design for sustainable fashion, and further research may be needed to fully understand the implications and effectiveness of this approach. There are still many opportunities to apply this concept to promote knowledge about and experience in the design of local handicrafts. That is why this study used the co-design approach and Kolb's experiential learning model to create a digital co-learning experience for enhancing the design of local handicrafts. The digital platform provides appropriate tools to enhance the interactions between consumers and craftsmen to support the process of knowledge creation while involving potential consumers in product

development. For instance, the digital platform should include features such as a user-friendly interface for consumers to explore existing product designs, a space for consumers to share their ideas and adapt existing designs to suit their needs, and a marketplace where producers can showcase their skills and connect with potential consumers. By incorporating these features and ensuring a seamless user experience, the platform would effectively facilitate collaboration between producers and consumers and create a market for niche handicraft products. The result was a novel digital platform that supports the co-learning process for designing handicrafts and provides opportunities for users worldwide to increase their learning experiences.

The results show that consumers are willing to participate in co-design activities within the design process. Co-design activities have shown their potential as a medium for the transfer of knowledge from the consumer to the producer. The handicraft producer acquires knowledge through co-design activities which reveal the ideas, as well as wants or needs, of the consumer. It results in the creation of products that satisfy the consumer's expectations. Consumers, as product creators, are willing to promote and share the products they create. By providing a platform for direct communication and collaboration between consumers and producers, the digital platform can streamline the design process. Producers can quickly uncover and comprehend consumers' wants and needs, leading to faster product development. This not only reduces the time it takes to satisfy consumers, but also increases the likelihood of the final product meeting their expectations. As a result, consumer satisfaction can be significantly improved, leading to positive word-of-mouth promotion and increased consumer loyalty. A digital platform would allow consumers to explore their needs and ideas in a convenient and accessible manner. They would have the opportunity to browse through existing product designs and adapt them to suit their specific requirements. This would enable them to create personalized products that align with their preferences and needs. Additionally, the platform would provide a space for producers to showcase their skills and expertise, allowing them to connect with potential consumers who are specifically looking for their unique products. This would, in turn, create a market for niche handicrafts and increase the visibility and reach of the producers.

This research contributes to the design process of handicrafts through a virtual environment that integrates the co-design approach and Kolb's experiential learning model. Handicraft design offers individuals the chance to explore their creativity, develop practical skills, showcase their unique creations, and potentially turn their passion into a business opportunity. To expand the market potential of local crafts and preserve traditional craftsmanship, local artisans can collaborate with international consumers. Connecting, and fostering the engagement of consumers from around the globe with the handicraft community can stimulate local economic development through the design of products based on local wisdom and resources, and, thereby, stimulate opening of new markets.

The study was limited solely to the system that was produced, which is only applicable to the design of textile products. Therefore, the system has to be tested, and its applicability to other handicraft sectors determined. Furthermore, understanding the challenges and barriers faced by producers in implementing co-creation and collaboration strategies and identifying possible solutions to overcome these challenges also needs to be explored. In conclusion, co-design activities have shown their potential as a medium for knowledge transfer from consumers to producers in the handicraft industry. By developing a digital platform for the collaborative sharing of knowledge and ideas, producers can better understand consumer needs and adapt their products accordingly, while consumers can create and share products that meet their expectations. This platform not only facilitates collaboration, but also helps create a market for niche handicraft products. To fully realize these benefits, careful consideration should be given to the development and implementation of the digital platform, ensuring that it matches the abilities of the producers and the needs of the consumers.

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