

INVESTIGATING APPROACHES OF TRANSFERRING TACIT KNOWLEDGE TO NOVICES WITH A THEORETICAL VIEW

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Abstract. Design students should be prepared with the abilities required for creativity and comprehensive communication with users. Designers need to acquire effective interpersonal skills, experience, insight, and intuition from personal experiences to design instruction, practice, and assessment in user experiences. However, this is knowledge that is difficult to acquire and teach. Furthermore, following the development of the master–apprentice relationship and studio-based learning, design education is greatly under the influence of technological advances. Some advanced techniques, such as video ethnography, real-time experiences, and immersive reality, can enable designers to simulate nonverbal experiences effectively and assist the development of creative design. These techniques foster an environment to help students construct a discursive relationship through analysing the unwritten, experience-based tacit knowledge of the practices of design and teaching. Several approaches with updated techniques for knowledge transmission were examined. This research is exploratory and aims to transfer tacit knowledge from the social community services experience to initiate design concepts more effectively. Digital synthesis and simulation approaches help students to construct knowledge identification more effectively in the design process. Appropriated digital approaches of tacit knowledge transition and transmission will further reveal knowledge refinement as a basis to evaluate creative design outcomes; further, this could enhance knowledge specification investigation into the quality of product evaluation.

Keywords: *tacit knowledge, design education, knowledge transfer, knowledge management, types of knowledge.*

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1. Introduction

Before the 1940s, the knowledge transmission process was heavily dependent on experience. Learners followed their teachers and learned from practice. Thus, the master–apprentice relationship has a historical connection to the tradition of crafts. This master–apprentice model of knowledge transmission approach was challenged under the influence of industrial development from the 1950s (Falzon, 1991). During this time, many large-scale industries started manufacturing development in Europe. To accelerate the transition and transmission of knowledge for mass production in the manufacturing industry, manuals and guidelines were emphasised as the main media to assist learning groups (Gray, 2013) in understanding fundamental instructions in studios and factories. Knowledge Transfer encompasses several terms, including transfer, translation, usage, and management (Graham, 2008). Some scholars pointed out that the phrase ‘Knowledge

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Transfer' generally is insufficient as it implies a one-way transfer of information (Quarchioni, Paternostro & Trovarelli, 2022; Duan & Jin, 2022). The physicians and decision-makers did not want to participate in this procedure without a communication mechanism that allowed for discourse. Thus, in this study, the 'Knowledge Transfer' in this study included a wide meaning, including the transition and transmission, usage, and management of knowledge. However, knowledge transition and transmission through manuals and guidelines were not applicable in some high-skilled industries that blossomed under the influence of advanced technology. Highly knowledgeable experts were needed in some simultaneously innovative, massive manufacturing endeavours, such as nuclear reactors, spacecraft engineering, hypersonic flight, and bullet trains. To increase productivity across these industries, advanced skills obtained from experience and insight were needed (Norman, 1988). Hence, there was a niche to explore how these skills and knowledge could be utilised in the technology boom. By adopting the suggested technique to transfer tacit knowledge from communities, novice design students will develop technologies to examine in-depth information and jointly generate knowledge. The knowledge management method will be further discussed, elaborated on, and developed by those students. They will become more motivated for additional in-depth discussion after the real-world experience.

2. Three basic types of knowledge

2.1. Introducing the three basic types of knowledge

During the formation of the knowledge transition and transmission framework, some scholars identified different kinds of knowledge (Ryle, 1945; Johannessen, 2022). In his book, *Personal Knowledge*, Polanyi (1958, 1967) was the first to examine the formation of three types of knowledge: expressive knowledge, descriptive knowledge, and tacit knowledge. The corresponding concepts could be summarised as follows (clearer comparisons are presented in Tables 1 and 2):

- *Expressive knowledge* is the knowledge that is easily articulable, codifiable, storable, and accessible. It can be communicated officially and methodically and can be distributed as information, scientific formulas, specifications, and manuals (or other similar documents). As soon as the syntactical principles that are necessary for decoding it are understood, it is simple to codify and, as a result, may be transmitted without any loss of its integrity (Quinn & McArthur, 2021).
- *Descriptive knowledge* may be expressed via the format of a declarative phrase or an indicative statement. It is specific factual knowledge that can be articulated by our various theories, conceptions, principles, schemas, and ideas; it incorporates a person's descriptive understanding of his immediate surroundings and the systems that control them. The vast majority of expressive knowledge and descriptive knowledge is explicit knowledge that may be preserved in many sorts of media (Hoffmann *et al.*, 2022).
- *Tacit knowledge* refers to information that is difficult to articulate or discern. Therefore, it is harder to impart to others via the techniques of writing it down or verbalising it. It includes wisdom, experience, insight, and intuition gained from one's personal experiences. It is common practice to see expressive knowledge and descriptive knowledge information as a supplement to a tacit understanding (Marinkovic, 2021; Chai, 2022).

Table 1. Definitions of the different types of knowledge

	Explicit knowledge		Implicit knowledge
	Descriptive knowledge	Expressive knowledge	Tacit knowledge
Definition	<p>Knowledge that can be stated via the format of a declarative phrase or an indicative statement</p> <p>Specific factual knowledge can be articulated by our various theories, conceptions, principles, schemas, and ideas (Angioni, 2004).</p> <p>A person's comprehension of the universe and the mechanisms that govern it is based on the descriptive information they have acquired over their lifetime (Khezrlou, 2022).</p>	<p>Knowledge that is easily articulable, codifiable, storable, and accessible</p> <p>Expressive knowledge can be communicated officially and methodically and can be distributed as data, scientific formulas, specifications, and manuals (or other similar documents).</p> <p>As soon as the syntactical principles that are necessary for decoding it are understood, it is simple to codify and, as a result, may be transmitted without any loss of its integrity (McInerney & Day, 2007).</p>	<p>Knowledge that is difficult to describe or extract</p> <p>Tacit knowledge is more difficult to transmit through the methods of writing or verbalisation.</p> <p>It can be categorised as relational tacit knowledge, somatic tacit knowledge, and collective tacit knowledge (Bao & Zhao, 2004).</p>

Table 2. Differences between explicit knowledge and implicit knowledge

	Explicit knowledge	Implicit knowledge
Codifiability with the mechanism in transferring knowledge	Explicit knowledge may be readily conveyed from one person to another without the need for the person to have the knowledge themselves (Bao & Zhao, 2004).	Tacit knowledge is information that relies on intuition and cannot be shared, comprehended, or used unless the 'knowing subject' is present. Transferring tacit information requires in-depth conversation and the development of mutual trust and understanding (Angioni, 2004).
Main methods for acquisition and accumulation	It is possible to develop explicit knowledge via the process of logical deduction. It may also be learned through practical experience in the proper environment (Angioni, 2004).	The only way to acquire tacit knowledge is via direct, hands-on experience in the setting in which it will be used (Bao & Zhao, 2004).
Potential of aggregation and modes of appropriation	It is possible to amass explicit knowledge in a single area, preserve it in objective forms, and appropriate it without the active involvement of the individual who has the knowledge (Bibi <i>et al.</i> , 2021).	Tacit knowledge is individual and dependent on context. It cannot be readily compiled since it is dispersed among those who possess it. It is necessary for the knowing subject to actively participate and cooperate for it to realise its full potential (Corso <i>et al.</i> , 2009).
Process of transforming	Codification, articulation, and specification are all terms that refer to knowledge that may be specified explicitly (Corso <i>et al.</i> , 2009).	Wisdom, experience, insight, and intuition are gained from one's personal experiences (Roehr-Brackin, 2022).

2.2. Transition and transmission approach of tacit knowledge

The epistemological distinction between explicit knowledge and tacit knowledge was recognised when Nonaka and Takeuchi (1995) investigated the problem of accessing immaterial and subjective wealth. In professional fields, explicit knowledge was often developed based on manufacturing industry terminology, including methodologies, schematic presentations, and industrial documentation. It was also more dependent on verbal communication and instructions (Omodei *et al.*, 2005). However, explicit knowledge was not the only knowledge that led to the development of society (Ericsson & Simon, 1980). Nonaka and Takeuchi (1995) identified that experience was the key to unlocking tacit knowledge. Since it is personalised and context-specific and hence complex to understand and explain, tacit knowledge is difficult to formalise and convey. As described by Nonaka and Takeuchi, tacit knowledge is sufficient for training novices. However, it is difficult for operators to explain all their aims and purposes because there is a lack of suitable vocabulary in existing languages (Daniellou & Rabardel, 2005; Ermine & Boughzala, 2006). When examining the transmission of tacit information, however, explicit knowledge cannot be ignored (D'Cruz *et al.*, 2009). These two types of information are interconnected in the same manner that an item's motion cannot be isolated from the item itself. It is common practice to see explicit information as a supplement to a tacit understanding. Other than for analytical reasons, we would never discuss the movement of an object and the object itself as two independent entities or states. Similarly, tacit knowledge and explicit knowledge cannot be isolated from their respective contexts of application. Nonaka and Takeuchi (1995) also identified this connection when they stated that organisational knowledge is formed via an ongoing blending of tacit and explicit knowledge. The transmission of tacit information occurs via interaction (i.e. by actual application). While explicit information is defined and conveyed orally, tacit knowledge is understood largely via behaviour. In the same manner that one might presume that explicit information will 'fade away' if it is no longer communicated via languages, tacit knowledge will also 'fade away' if the actions connected with it cease to exist (Gill, 2016). The interaction that exists between the experienced professional and the novice is crucially significant for the transmission of the foundational principles of tacit knowledge. Sometimes, the transition and transmission of tacit knowledge result in the apprentice creating something new. There would be fewer innovations if it were not for students' 'translations' of circumstances. Cooperation, as a fundamental prerequisite for the transmission of tacit knowledge, is something that Nonaka and Takeuchi (1995) emphasised as well. Working together as a cohesive unit is essential for successful development, thus a master–apprentice relationship would enhance the transition and transmission of tacit knowledge. Understanding the setting in which tacit knowledge is generated and communicated makes defining collaboration a critical component of that understanding.

Tacit knowledge transfer can occur from master to novice in a 'learning by interacting' process. For such a learning situation to take place, the collaborative system must be based on trust and a mutually helpful attitude. In this context, the collaborative system consists of the master (i.e. 'the one who knows') and the novice (i.e. 'the one who wants to know'). Furthermore, routines must be established that structure this relationship, and the relationship must be goal-oriented so that progress can be measured. The master–novice relationship is crucial in the transfer of tacit knowledge. Nelson and Winter (1982) pointed out that the function genes play in the notion of biological evolution is also played by these procedures in our version of evolutionary thought. Thus,

the master–novice connection is essential to the successful transfer of tacit knowledge. It should be emphasised that the master–novice (or master–apprentice) relationship has a historical connection to the tradition of crafts. However, the master–apprentice relationship applies to all types of relationships where tacit knowledge is transferred from ‘someone who knows’ to ‘someone who wants to know’. Professional expertise is established by these specialists, who then pass down their knowledge and experience to the next generation (Palter *et al.*, 2010). Mentoring in specialised crafts as a process of the socialisation method is often employed in manual industries to cognitively facilitate ‘in-person interaction’ and ‘the exchange of first-hand knowledge’ among professionals and novices. Tacit knowledge involves individual learning experiences that are not sufficiently present with verbal communication. It is assumed that tacit knowledge is developed by repetitive brain reflex training; the expert's physical actions trigger conditioned responses. Hence, providing tacit knowledge training is becoming more complex (Earl, 2001). To summarise, the formation and collection of specialised know-how for transmission purposes was briefly developed and aroused concerns on methodological issues such as knowledge management (Earl, 2001; Jacobs & Park, 2009).

2.3. The management of knowledge

Knowledge management was developed under the umbrella of knowledge. There are three main steps in the knowledge management process: exchanging, transferring, and uptaking. It is recognised as a systematic process to prepare knowledge (i.e. the result of combining data and information) for developing effective decision-making; it includes expert opinions, skills, and experience. After decades of development, the objective of knowledge management is to distribute the appropriate knowledge and implement the desired methods to the target audience. This objective provides a guideline for criticising the components of knowledge in relation to various aspects, including culture, content, technology, and the process itself. In other words, the culture of a learning group is responsible for effectively managing knowledge with strategic communication.

3. The proposed approach for transferring tacit knowledge from communities

In past decades, scholars were mostly concerned with how technology would be utilised to preserve and transfer highly skilled professionals' tacit knowledge (Clot & Kostulski, 2011). Derived from the theories of knowledge management, the updated definition of knowledge transition refers to a procedure that consists of the organisation, generation, capture, and distribution of knowledge (Crego & Harris, 2002). Knowledge transition is an important step in laying the groundwork for the availability of knowledge for future application or development in this information boom era.

4. Real-time experiences in education

Some scholars have explored the application of real-time experiences in design education. Learning design requires a synthesis of the creative process with an understanding of relevant theory and the ability to apply that theory in the real world. Studio-based education is the standard across the board in the design fields, from style creation design and visual communication design to industrial design and interior design. The methodology relies heavily on a setting that fosters an atmosphere conducive to the

emergence of novel ideas. This time-honoured method of classroom organisation has frequently proven to be effective in encouraging students' participation, productivity, and socialisation (Shreeve, 2012). The pandemic has, regrettably, separated students from their classrooms. As a result, using digital tools to improve educational results has become essential (Shaqour, 2021). Fortunately, distance and time constraints are not issues in virtual classrooms. The internet's ability to provide worldwide collaboration and instruction from instructors globally is a significant benefit. According to Posey (2010), students worldwide may benefit from using digital resources to share ideas, collaborate on projects, learn about one another's cultures, and appreciate the similarities and contrasts in their perspectives. Web-based education has many advantages, but its portability, accessibility, and capacity for introspection stand out (Graham, 2006). In a digital classroom, comments may be saved and referred to later (Senyapili & Karakaya, 2009). For example, a study that focused on the School of Design and Innovation in Mumbai during the COVID-19 pandemic showed that real-time experience online would be applied to provide real-world learning opportunities. This case study records the different responses taken by a design school in their Product Design undergraduate programme during the pandemic and evaluates the results for students' educational outcomes. The School of Design and Innovation in Mumbai took measures to ensure that its academic approach was not significantly diminished and made an effort to provide students in online classes with real-world learning opportunities. Teachers adapted their methods of instruction and mentorship to the changing needs of their students in the digital age. Students' increased participation in class may be attributed to the introduction of novel material delivery systems and methodologies, as well as positive dialogue with teachers and group projects involving several students.

4.1. Video ethnography

Some scholars proposed applying video media to training systems in the design and creative industry and also introduced the concept of ethnography research in a video application. Some further suggested that video ethnography involves observation, which includes the extensive filming of practitioners (Eary, 2008); reflection, which encourages practitioners to watch recorded video tracks and critically reflect on their own practices (Jowett *et al.*, 2007; Knoblauch *et al.*, 2006); and transformation (Mondada, 2003). Carroll and Kerridge (2008) pointed out that the video ethnography method develops expertise during the working process. Based on discussions with practitioners in their study, Carroll and Kerridge (2008) suggested that articulations developed from videos about societal, occupational, ecological, and organisational inadequacies are all considered and allow professionals to set limits on their work. In addition to shooting footage, practitioners obtain a more in-depth understanding of the linked knowledge if they discuss their routines after watching the videos with others (Goldman, 2007; Goldman *et al.*, 2014). They also gain insights into areas of practice that provide benefits for the new generation (Organisation for Economic Co-operation and Development, 1996).

4.2. Immersive reality

Regarding the concept of education, more and more discussions concern methods of demonstration. Some scholars recommend visual demonstration as a way to transmit information to students. Visual demonstrations like videos are fascinating as a method of information transfer. Model learning is not only simple information-sharing but also provides a visual demonstration and influences students' motivation. Thus, some scholars suggest that visual demonstration is a procedure in which a subject examines a model's behaviour and modifies it according to its performance because of engagement (Holland *et al.*, 2002). It is an efficient way of learning both basic and advanced motor skills. Students who are allowed to physically interact with activity are more likely to acquire the desired skill.

Researchers have widely implemented immersive reality in different applications (Hamilton *et al.*, 2002). Immersive reality is a combination of visual and interactive technologies in a virtual environment. It is often illustrated in a three-dimensional (3D) space, either realistic or imaginary. The logic in a virtual environment can be built according to 'realistic physical laws of dynamics' or 'imaginary dynamics' (Hamilton *et al.*, 2002). The scenarios in the virtual environment are proposed to apply broadly to different fields of education. One of the key features of immersive reality techniques is their 'multi-sensory interaction' (Pastre & Kayal, 2006). After visualising space in the scenarios, the audience interacts with space through the combination of 'multi-sensory visualisation'. Such a highly interactive experience provides the advantage of applying immersive reality techniques in education (Hamilton *et al.*, 2002). It is regarded as an ideal tool suited for effective active learning. Immersive reality is an alternative approach that enables seamless transitions between digital and real-world immersive reality. It changes how we understand, imagine, and learn about the environment around us. Anatomy 4D is a fantastic example of how immersive reality development may be used. In this software, students view an interactive 3D representation of the human body after scanning printed targets and can explore it however they choose. It makes it possible for instructors and students to see 3D models in the real world in real-time and at the appropriate size. Before immersive reality, real-world artefacts or props were used in educational settings as a way to practice. As Pastre and Kayal (2006) discovered, in a collaborative situation, speakers use props and realia to generate a meaning that is socially shared. How the physical items look, the physical affordances they possess, and how they might be used as semantic representations all contribute to the fact that they facilitate cooperation. Learners' attention is concentrated on spatial interactions and their capabilities. Within the realm of immersive reality, there is a close connection between the virtual and real worlds. The actual items might be improved in ways that are not normally conceivable, such as by offering a context-sensitive visual appearance, private and public data display, dynamic information overlay, and physically based interactions. Augmented reality applications built on a physical interface metaphor make use of real-world items as metaphors for interacting with and manipulating virtual data. As a result, even those with no prior knowledge of computers can have a satisfying interactive experience. In the Shared Space interface, users can handle 3D virtual items by simply moving actual cards that the virtual models seemed tied to. Even young children can benefit from the many educational opportunities provided by this application.

The constant improvement and growth of digital technology have hastened the progress of communication media. When it comes to education, art, medicine, exhibitions, and the general public's understanding of scientific concepts, immersive reality

technology has come of age. For example, wearing immersive reality glasses enables users to accomplish spacetime scheduling in several directions and dimensions, allowing them to see more virtual settings and scenarios. Scholars have termed immersive reality as a technology that allows digital elements to be superimposed on physical images in real-time (Gonzalez-Franco *et al.*, 2017). Synchronously, this technology provides both virtual and live-action imagery. In immersive reality, the user's virtual data are superimposed over the real world, creating a new environment in which the user may engage with the virtual content. Based on the technology used, immersive reality apps may be further categorised as either marker-based or markerless. Symbolic items are collected by a computer through a camera in marker-based immersive reality apps, which then display the corresponding virtual content. Markerless apps, including location-based immersive reality apps, utilise a global positioning system to determine the user's physical location and then provides relevant virtual information in strategically significant nearby locations.

Recent research on the use of immersive reality apps in the field of theatrical education demonstrates the positive impact these tools have on both academic performance and student outlook (Halabi, 2020). Motivational or expertise attainment is recognised as an essential part of the progress of instructional aids, and a study from the New Media Center (Halabi, 2020) found that immersive reality has the potential to significantly alter educational settings in several ways. Similar to how they would assess other immersive reality applications, teachers should consider how immersive reality apps could connect to certain teaching strategies or pedagogical methods when used in the theatrical education field. Research suggests that teachers may combine immersive reality applications with other instructional strategies, such as contextual learning, inquiry-based learning, and game-based learning, by integrating immersive reality into education (Halabi, 2020).

5. Discussions and idea exchange

In light of advanced technology development, we exist in a world where decisions and options are profoundly influenced by the quality of the information we receive. At the same time, driven by technological improvements in telecommunication, information and communication technology has increased cooperation, collaboration, cost efficiency, and educational enhancement. These changes have influenced people's general living standards and needs in developed regions. They have also revolutionised theoretical development and applications in education. Educational theory, also known as pedagogy, articulates the fundamental ideas that underpin instruction in every given institution and provides a framework for translating learning goals into the learning environment. A new style of learning necessitated the adoption of novel pedagogical strategies to achieve set educational goals and maintain students' interest throughout the whole process. To properly deliver on these aims, extensive planning was done at numerous levels, including the school, departments, and faculty. Students were required to navigate through a digital landscape to thoroughly attend to the social and cultural life around them. Hence, there is a need to reconsider the learning environment design to enhance students' determination and exploration. More scholars are concerned about how communities and industries will investigate updated digital-based solutions for preserving and transferring know-how processes compiled by experts (Mollo & Falzon, 2004). Additionally, the learning style of novice design students in the new generation has also changed. Novice designers and classroom students sometimes do not know how to collaborate effectively (Oblinger &

Oblinger, 2005). Oblinger and Oblinger (2005) pointed out that, since growing up in an era of media saturation as well as conventional approaches to digital technologies, novice design students today attain unique approaches to thinking, communicating, and learning. They are equipped with sufficient computer knowledge and skills for application and can search for information by themselves through search engines (Prensky, 2006). They prefer engaging socially with their peers rather than learning unless they find the manipulation of the learning group interesting.

By applying the proposed approach for transferring tacit knowledge from communities, novice design students will employ real-time technology, such as video ethnography, real-time experiences, and immersive reality, to explore in-depth information and construct knowledge together. Those students will further conduct discussions, elaborate, and develop exploratory talks in the knowledge management process. Once novice design students obtain real-time experience, they will develop greater motivation for further in-depth discussion.

5.1. Needs of novice design students

Novice design students need stronger motivation (Chan & Ma, 2022) for exploring in-depth information and constructing knowledge together. They perceive group discussion as a goal-oriented activity. Once they think the teacher's questions have been answered, they may not go further into the in-depth discussion. The strategies presently applied are generally ineffective in developing exploratory talk for every student. As a result, there is a need to explore how information and communication technology tools can help to develop co-constructed discussions. It would be helpful to have some insights that would aid educators in efficiently using the many tools provided by information and communication technology. Teachers could assist students in conducting their collaborative learning by asking questions, providing reasons for their views, building on other ideas, criticising other ideas, sharing pertinent information, and seeking agreement on joint choices based on pedagogical viewpoints.

5.2. The proposed new model

Derived from the theories of knowledge management, the updated definition of knowledge transition refers to a process that includes organisation (Pea, 1994; Polanyi, 1958, 1967), generation, capture, and distribution of knowledge (Hutchins, 1995). Knowledge transition is a procedure of establishing the vital importance of knowledge availability (Polanyi, 1958, 1967; Powell *et al.*, 2008; Rix-Lievre & Lievre, 2010; Robson, 1993; Rogers & Ellis, 1994; Ryle, 1945) for future application or development in this information bloom era. As a result, the proposed concept would answer the need to explore how information and communication technology tools can help to develop co-constructed discussions. It is expected that the findings would provide insights to teachers as to how to apply effective use of information and communication technology tools. Teachers would help students to conduct their collaborative learning by asking questions, reasoning their ideas, building on other ideas, challenging other ideas, sharing relevant information, and seeking agreement for joint decisions from pedagogical perspectives.

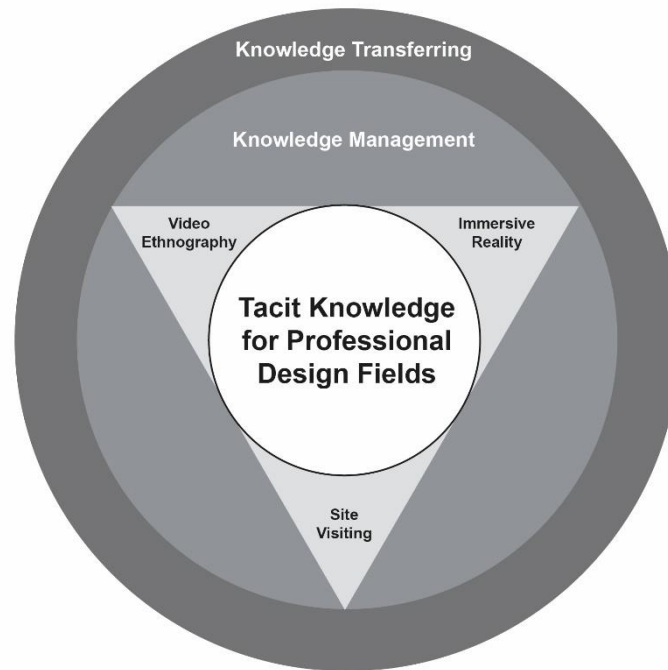


Figure 1. The proposed model illustrates how the different approaches work in the process of transferring tacit knowledge

6. An empirical study for investigating approaches to transferring tacit knowledge to design learning

6.1. Research method and process

An empirical study was conducted to investigate the patterns of combining visual elements to motivate students to focus, follow instructions, and complete their work. Eighty-eight first-year undergraduate students were randomly asked to participate in this study by answering a Teaching Feedback Questionnaire after school. Same as other classes in the university, a class is enrolled by 44 students. They enrolled in the course in the Year 2021 (site visiting and Google Classroom) with a traditional face-to-face learning approach and in the Year 2022 (video ethnography and Zoom discussion) with computed technology. All students had experience in applying learning tasks via online platforms per teacher instructions. They also had experience in knowledge construction by applying different approaches, including site visiting, video ethnography, and immersive reality. As such, they were ideal participants for providing sufficient feedback on how learning approaches influence their knowledge construction; therefore, their feedback will be a reliable source for investigating knowledge construction patterns that combine visual elements to enhance student motivation. Three interfaces in online learning platforms were selected as examples for the students to use. Since all of the participants had learned Chinese and English in school, all three platforms were delivered in these two languages in this study. The Teaching Feedback Questionnaire asked the students how they felt about their learning experience during the course.

6.2. Research result

Each participant rated their learning process for both two years (in both English and Chinese versions). Rates concerning the effectiveness of two different approaches (typical face-to-face approach in transferring tacit knowledge and delivering tacit knowledge through computed technology. to the design learning group and evaluated, as shown in Figure 2 below.

Analysis aspects in transferring tacit knowledge	Questions asked in Teaching Feedback Questionnaire	Year 2021 (site visiting and Google Classroom)						Year 2022 (video ethnography and Zoom discussion)					
		A	B	C	Resite	Fail	Mean Score	A	B	C	Resite	Fail	Mean Score
The performance of the learning outcomes	Result statuses	19.61%	68.63%	10.78%	0	0	61.78	20.00%	70.00%	10.00%	0	0	63.22
		Strongly agree	Agree	Netural	Disagree	Strongly disagree	Mean by question	Strongly agree	Agree	Netural	Disagree	Strongly disagree	Mean by question
The satisfaction of the learning performance	The course meets the stated learning outcomes.	79.55%	18.18%	2.27%	0	0	4.77	71.43%	23.81%	4.76%	0	0	4.71
The effectiveness of knowledge identification	The course was well organised and ran smoothly.	81.82%	15.92%	2.27%	0	0	4.19	73.81%	21.43%	4.75%	0	0	4.24
The effectiveness of knowledge specification	The course has improved my competency in related academi/professional contexts.	79.55%	15.91%	4.55%	0	0	4.18	73.81%	21.43%	4.76%	0	0	4.22
The effectiveness of knowledge refinement	The course was stimulating and valuable.	79.55%	18.18%	2.27%	0	0	4.19	73.81%	16.67%	9.52%	0	0	4.24

Figure 2. Effectiveness rates for each approach in transferring tacit knowledge to the design learning group

6.3. Discussion

The digital design process is a kind of thinking that knits together the intellect, the body, and the material world to create something new and dynamic. Figure 1 compares the different approaches to transferring tacit knowledge to the learning group. From the figure, it is evident that the most important way of thinking is knowledge transferring, followed by knowledge management (Marinkovic, 2021), which includes knowledge identification, knowledge specification, and knowledge refinement. Throughout the process, both ways of thinking are brought into play in alternating fashion (Bolt, 2004). When one way of thinking moves to the forefront of consciousness, the other ways of thinking move to the background. Therefore, the way of thinking and the activities that digital media designers engage in affect the quality of the work that they produce.

Also, in Figure 1, the different phases of knowledge development are shown as three levels that rotate through their respective functions. As the students continue to acquire new information, the size of the rings will adapt to reflect the changes in their level of comprehension. No thinking moves should be ignored, or the process of innovating new designs might be disturbed (Smith, 2015). Kampen (2019) discovered that a single action might take place under all the ways of thinking after observing and analysing an interactive design course. Due to the cognitive topic, one of the thinking modes that the students possess is triggered; because design thinking is the first and most essential mode, actions taken inside this mode have a direct influence on whether a work addresses issues that exist in the real world. The interaction between the designers and the objects leads to insight, and material thinking is the empirical knowledge gained through practice, experiment, and trial and error (Kampen, 2019). This way of thinking functions as a significant and active mediator in the intellectual growth of humans.

According to the participants’ feedback shown in table 3. The 2022 participants (who applied video ethnography and a Zoom discussion) with computed technology, performance was slightly higher than the 2021 participants. Their mean score was also slightly higher; 2021:61.78%; 2022:63.22%). The 2021 participants obtained a slightly

weaker ability to think about materials in multiple dimensions was a factor in the design of their work. Shute, Sun, and Asbell-Clarke (2017) pointed out that knowledge specification encompasses six different components and techniques: breaking down complex problems into smaller ones, abstracting them away, creating algorithms, testing, debugging, and iterating on them. Knowledge specification is a way of thinking used in computer engineering and is a vital digital competency in the twenty-first century, especially for students majoring in digital media design. Knowledge refinement in the process of painting is an analytical thought process for digital media designers and serves as an element of the concrete action–perception cycle. The astute use of knowledge refinement functions as a supplement to the programming language that falls under computational thinking. The shortcomings of design thinking are ameliorated when combined with the complementary applications of knowledge specification and knowledge refinement. The findings support the proposed model, which demonstrates that to reform the teaching of digital media design in studios, instructors need to be prepared with professional thinking and cognition (Bailey & Borwein, 2011). This is essential to promote the thinking modes and behaviours shown by the students. As the alternation between explicit and tacit information develops, students will need to socialise, externalise, integrate, and internalise the knowledge they acquire in studios. This will cause them to experience a development path in the shape of a spiral.

This study was conducted by applying a quantitative questionnaire, and the results were summarised in the form of practice. It is possible to conduct more research to quantify the activities of instructors and students, as well as research on the assessment of work; this would provide more credible support for reforming digital design education and teaching.

7. Conclusion

As a part of the learning group regarding intelligence, history, and culture, knowledge was recognised as the underlying factor for the microeconomic development of society. It also influenced the productivity of the learning group. Thus, there are increased concerns about its influence on information, technology, and economic performance. While knowledge and technology were identified as the most critical foundations for the construction of the economy, labourers in the next generation were required to gain several skills and expertise. These skills and knowledge were grouped as tacit knowledge closely linked with specific skills from learning groups and industries in design education. Tacit knowledge practices are the result of co-contribution between the fields of science, technology, and industry in society's learning group. These tacit knowledge practices are recognised as fundamental professional knowledge and practices that designers must comprehend. Tacit knowledge involves individual experience, understanding, and intuition and enables novice design students to evaluate the messages they deliver in the design communication procedure. However, it is difficult for designers and creatives to translate tacit knowledge effectively in writing or voice to respond to or react against it. There was a limited grasp of what the creatives and designers of the period were responding to or responding against and the experiences they had during that time. After examining the pertinent literature on knowledge transfer, this study analysed several methodologies – video ethnography, real-time experiences, and immersive reality – that can aid designers in simulating the effectiveness of nonverbal experiences and fostering the development of creative designs. With the use of digital synthesis and simulation

approaches, design learning groups can build knowledge identification more efficiently during the design process. Relevant digital tacit knowledge transfer and transmission techniques will help to explain knowledge refinement as a basis for analysing the outcomes of creative design; they will also enhance knowledge specification study on product evaluation quality. Based on the finding that virtual reality and video ethnography were possible approaches for delivering tacit knowledge from the expert learning group to novices.

Three tiers model through knowledge growth periods was discovered. The model will change size as pupils learn new material. If thought motions are disregarded, fresh design innovation may be disrupted. Design thinking, the first and most important thinking mode, is activated by the cognitive theme, and actions done in this mode directly affect whether a work solves real-world concerns. Material thinking is practical knowledge obtained via experience, experiment, and trial and error. Designers get insight through interacting with items. This manner of thinking promotes intellectual advancement. Video ethnography and a YouTube/Zoom chat (helped students outperform those learning in traditional approach (e.g. face-to-face). Those learning in the traditional approach participants' somewhat reduced capacity to think about materials in several dimensions influenced their work. Knowledge involves six steps: breaking down complicated issues, abstracting them, constructing algorithms, testing, debugging, and iterating. In the 21st century, knowledge specification, a computer engineering method of thinking, is essential for digital media design students. This is a preliminary investigation into how to effectively impart tacit learning group knowledge to novices.

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