Cross-cultural awareness in game-based learning using a TPACK approach

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Abstract:

Our paper focuses on promoting cultural awareness through game-based learning using the Technological Pedagogical Content Knowledge (TPACK) framework. The TPACK framework, proposed by Mishra and Koehler (2008), is widely used as an organising frame for the development of education technology. This framework takes into consideration the use of effective pedagogical practice to enhance teaching and learning environment. Hence, we are looking at using the framework to promote the development of cultural awareness technology and content, by introducing the extended TPACK. We draw a need to expand the TPACK by incorporating another dimension that is thekey cultural elements, within the Pedagogy, Content, and Technology components, to mutually interact, in order to promote cross-cultural awareness on a game-based learning (GBL) platform. Specifically, the content-knowledge for promoting cultural awareness would include key elements of cultures. The pedagogical-knowledge includes methods and strategies to promote and encourage understanding and respect of a culture. The advancement of game technology can be capitalised to encourage and sustain engagement in a learning platform. Presently, the work on cross-culture awareness in games is still very limited. As such, the aim of the development of a GBL platform using the extended cultural TPACK framework would be to expose learners to culturally diverse scenarios and engage as well as expose learners to knowledge of the different cultures in myriad ways.

1 Introduction

Cultural literacy (Brooks, 2004) equips individuals in dealing with exposures to culturally diversified situations that stem from multi-ethnicities, cross-cultural pollination and inter-generational evolution. The speed by which customs and traditions evolve and cross-pollinate is highly influenced by the rapid integration of regional economies, societies, and cultures through a globe-spanning network of communication, collaborations and immigrations.

To offset cultural ambiguity, division, confusion and stereotypes, it is essential to promote "*cross-fertilisation across all boundaries, between 'majorities' and 'minorities', 'dominant' and 'sub' cultures, localities, classes, faiths, disciplines and genres, as the source of cultural, social, civic and economic innovation*" (Flemming & Comedia, 2009). Before addressing cultural issues within a more global setting, *cultural awareness* has to be nurtured at the root level. Preserving one's own culture is as important as promoting cross-cultural awareness. Understanding and respecting another culture start at home, where one's own set of values has to be instilled before developing understanding of others.

This is in tandem with the concept of pluralism and homogenisation. *Pluralism* aims to promote positive diversity by encouraging understanding and respect (McCartney, 2006). Britain, for example has become increasingly diversified in ethnic and religious terms as a result of continued large scale immigration from a wide set of source countries. *Homogenisation* goes beyond co-existence through tolerance by promoting one common identity based around citizenship and assimilating minorities into the society. Malaysia, for example, is running the '*1Malaysia*' campaign to promote homogenisation while celebrating diversity with its 137 indigenous languages and eight immigrant languages (Ethnologue, 2011).

These indigenous languages are part of the nation's cultural heritage that needs to be preserved for the next generation. Additionally, arts and crafts skills, local folks music and dances, food and heritage buildings such as Iban longhouses needs to be protected (Chin et al., 2010). The younger generation who are becoming more technology-dependent needs to be culturally aware of not only their own but other heritages as well.

From books to multimedia technology, one can utilise these media to learn history, culture, geography, socio-economy and architecture. Various kinds of technology-driven intervention have already been integrated into conventional teaching methods, which include web-based tools and mobile devices, social networking environments and computer games to support formal and informal learning experiences. With the advancement of virtual and web technology, access to knowledge is available for mass consumption, which naturally extends its deployment as a platform for self-learning. Within the domain of cultural heritage, virtual applications such as the Virtual Egyptian Temple (Jacobson et al., 2005), Virtual Anyang Xinxu (Xinju et al., 2007) and Virtual Gettysburg (Virtual Gettysburg) demonstrate the potential of such an engaging platform to present users with a virtual recreation of ancient buildings and artefacts. Virtual Environments (VEs) have also been used during the design and consultation stage of a hypothetical urban design project situated within Australia and China (Bucolo, 2004). Moreover, events and environments, such as, a battle in a computer-generated scene, can be recreated to allow users to move around and observe from any angle or location. However, "firsthand" or hands-on experience is not advocated by these environments (Arnab et al., 2010a). Thus, the transfer of cultural awareness from these VEs is not as effective as we want it to be.

To facilitate the transfer of cultural knowledge within a VE, the representation of the learning environment has to be considered, taking into account the complementary attributes of the selected technologies to learning within the context of cultural heritage. There is evidence that multisensory or multimodal interfaces can create a more active and interactive engagement with a virtual learning environment (VLE) (Chalmers et al., 2009). However, while sight and sound, the most common feedback supported by existing VLEs and most accessible senses to reach with conventional media, they are not the most sophisticated. "Hands-on" interactivity in support for experiential learning can be supported by haptic technology designed to communicate through subtle and sensitive channels of the tactile perception. In conjunction with the multimodal approach, tactile interaction is very useful in cultural applications, where ancient artefacts are mostly beyond reach in a physical world (Barbagli et al., 2002; Bergamasco et al., 2002; Dettori et al 2002; Brewster 2005).

Researchers call for innovative technologies to be used for cultural applications (Brogni et al., 1999; Brewster, 2001; Barbagli et al., 2002; Bergamasco et al., 2002; Dettori et al., 2002). There are many advantages with

using technologies such as augmented reality and haptic technology in the cultural sense, say in a museum environment for interaction with rare or fragile art pieces. As these valuable pieces are usually kept behind the display glass, visitors cannot experience fully the objects with their senses. Through VE, they are not required to be physically at the museum gallery but still be able to experience the artwork. For instance, The Museum of Pure Form (Frisoli, 2007) allows visitors to explore the museum via stereo vision and virtually interact with sculptures. Figueora et al. (2009) demonstrated a similar multimodal platform based on the Gold Museum in Bogota, where commercial devices were integrated in order to allow visitors to see in stereo, hear, and touch replicas of small objects. Rare art pieces can be "touched" in the Interactive Art Museum (Brewster, 2001; Barbagli et al., 2002). The visually impaired may also be empowered, where sight is no longer the only necessary sensory means to appreciate artwork or a virtual space in general (Kaklanis et al., 2009).

To promote engagement with the learning process and better absorption of knowledge, complete involvement of individuals in their learning process is essential. Experiential learning (Kolb 1984) advocates such engagement. In their model on exploratory learning, de Freitas and Neumann (2009) expand the experiential model to include the use of such virtual environments in learning. With advances in technologies and increase in learners' expectation, various domains are turning to the use of games on a virtual platform. These games encourage and sustain engagement as well as to promote transfer of knowledge via role-play scenarios often supported by a game-based platform. While computer game technologies more often associated with entertainment, this platform is often referred to as "Serious Games"- a platform for combining high-fidelity graphics and sound with engaging content, novel interfaces, and serious purpose. Though serious games are employed in a range of diverse areas such as healthcare, defence and marketing, the use of games in learning is rapidly emerging as a leading area for their use.

One notable virtual application, TiN, meaning 'At Home in Holland' is used by immigrants to successfully pass an integration exam as required by Netherlands' New Civic Integration Act (Schuurink et al., 2009). Thus, they would need to learn the Dutch language and the new immigrants to be integrated into the society seamlessly. To become an active citizen necessary for the society and economy, immigrants are provided with a virtual neighbourhood, participation game, participation guide and a measurement tool. The immigrants are measured through the amount of activities and the distinction of independence or with assistance when undertaking these activities. Apart from the need to become a citizen of Netherlands, immigrants are made more aware of various social norms and their culture so that they can easily be integrated into the society.

Another notable VLE is used as a "computer game for Adaptive Thinking and Leadership (ATL) training and skill development in intercultural and interpersonal communications among teams and in cross-cultural settings with host nationals" (Raybourn, 2005). Though only a game, this environment is important for the U.S. Army Special Forces before being deployed to their designated nations. The army forces would need to have a culture awareness of the designated nation before being sent out. Though that may not be in the mission, being culturally aware would be a great advantage for them to seamlessly adapt to the nation's culture and society.

With these technologies available, the key research question is: *How can we promote cultural awareness using game-based learning technology?* First, key elements of culture are identified based on Abdullah (1996), which

consist of two levels: conscious and unconscious. At the conscious level, there are symbols, rituals and heroes, which can be studied using quantitative methods. On the other hand, the unconscious level defines culture by immersing oneself with members of the culture that includes values and man's relationships with God, nature and people.

Today, there exist various game-based learning frameworks, however, only a few cover cross-cultural game-based learning technology. There is a need to have a more complete coverage or use of technology (Technology-Knowledge) to teach (Pedagogical-Knowledge) certain knowledge (in our case, cultural awareness). Thus, we propose the Cultural Technological Pedagogical Content Knowledge (CuTPACK) framework. CuTPACK aims to cover all of the aspects required for a game-based learning platform to support cultural awareness. In the next section, we will first describe the TPACK framework, followed by the proposed CuTPACK framework.

2 TPACK Framework

Technological Pedagogical Content Knowledge (TPACK, originally TPCK) was first proposed by Mishra and Koehler (2006), which is an integrated framework to clarify the type of content knowledge needed by a teacher for effective pedagogical practice in a technology-enhanced learning-environment. Figure 1 illustrates the TPACK framework and its knowledge components.

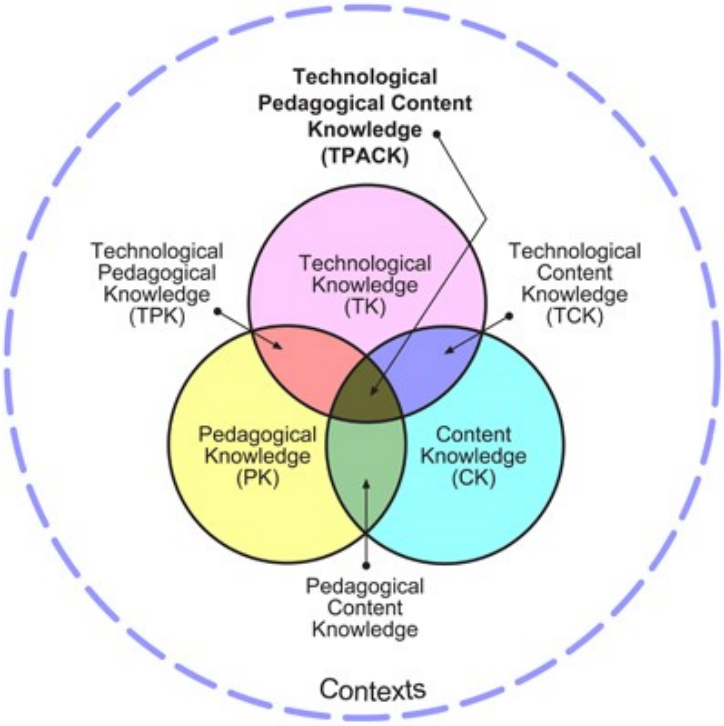

Figure 1: The TPACK framework (TPACK, 2010)

TPACK consists of seven different knowledge areas: (i) Content Knowledge (CK), (ii) Pedagogical Knowledge (PK), (iii) Technology Knowledge (TK), (iv) Pedagogical Content Knowledge (PCK), (v) Technological

Content Knowledge (TCK), (vi) Technological Pedagogical Knowledge (TPK), and (vii) Technological Pedagogical Content Knowledge (TPACK). All of these knowledge areas are considered within a particular contextual framework. In our paper, our context would be promoting cross-cultural awareness through exposure in game-based learning.

Content knowledge (CK) refers to the "knowledge about the actual subject matter that is to be learned or taught", which includes knowledge of concepts, theories, ideas, frameworks, evidence and proof, and knowledge on the approaches towards accepting and developing such knowledge (Shulman, 1986). Pedagogical knowledge (PK) is the knowledge on the processes, practices, students' learning, management, development, evaluation methods and strategies of learning and teaching content knowledge. Technology knowledge (TK) is applying and integrating digital technology tools with an aim to enhance learning environment (Harris et al., 2009; Harris, 2008; Shulman, 1986). The intersection that lies between CK and PK is Pedagogical Content Knowledge (PCK) that covers a new kind of "knowledge of pedagogy that is applicable to the teaching of specific content" (Shulman, 1986). Technological Content Knowledge (TCK) is knowledge about the manner in which technology and content influence and constrain one another. For example, the use of technology may be used to conceptualise and visualise the population and the movements of the Penan (ethnic group) nomads on Borneo island. The combination knowledge between TK and PK is how the use of particular technologies is *pedagogically appropriate* to change teaching and learning. For example online collaboration tools may facilitate social learning for geographically separated learners (Mishra & Koehler, 2006). This combination is referred to Technological Pedagogical Knowledge (TPK). The union of all the three elements is Technological Pedagogical Content Knowledge (TPACK). It emerges from a technological solution that properly combines content knowledge and pedagogy for teaching and easy learning.

Within the domain of game-based learning (GBL) and cultural heritage, we adopted TPACK framework in exploring games to support cross-cultural awareness in society. To do so, cultural parameters are identified for each of the content, pedagogy and technology elements. The next section elaborates on the cultural contents relevant to the knowledge of cultural awareness supported by a GBL paradigm.

3 The proposed cultural TPACK (CuTPACK) framework

For each element, we have identified the cultural knowledge that would be useful for games that promote cross-cultural awareness. Culture is define as "*a collection of behaviour patterns relating to thoughts, manners and actions which members of a society have shared, learnt and passed on to succeeding generations*" (Abdullah, 1996). In defining a culture, there are various elements that define the culture of a society (as described in (Abdullah, 1996)). The identified key elements of culture are symbols, rituals, heroes, values and man's relationship with God and people. Symbols refer to artefacts, objects, hand gestures, food, places of worships and greetings. Rituals are daily habits and ways of day-to-day life. Heroes are role models and key figures by their actions, articulated words and values. Unlike the three aforementioned elements, values and man's relationship with God and people factors are guided at the unconscious level, which means learning a culture is by immersing ourselves into the culture and then interpreting the meanings, feelings and emotions of the

subjects (Abdullah, 1996). Values are the "*should*", "*ought*", "*must*", and what we revere throughout our lives from a younger age. Man's relationship with a God or a deity and with people are ways people perceive the environment, world, belief, self and others. The summary of the key elements of culture is illustrated in Figure 2, in which man's relationship with a spiritual entity, nature and people is the core and the basic assumption of human existence. The middle layer is the norms and values. The outer layer reflects the explicit culture and is visible.

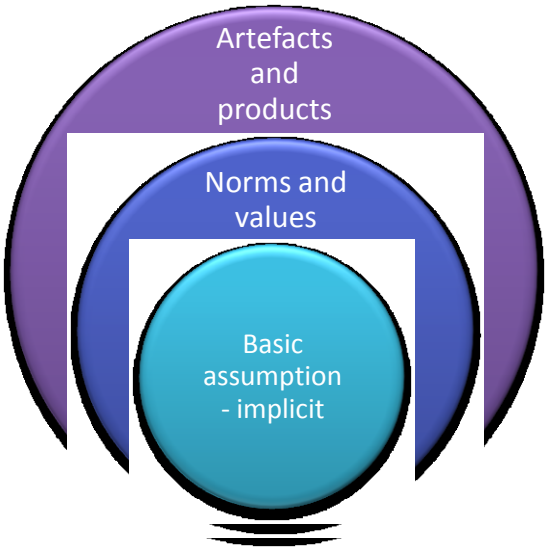

Figure 2: A conceptual model of culture (Trompenaars, 1994)

The content knowledge for promoting cultural awareness should include the aforementioned key elements of cultures. For example, given a specific scenario of the lifestyle of an Iban native in Borneo, the culture content would be information about the longhouses, the *pua kumbu* fabric, the Iban language, the (historical)headhunter warriors, their greetings, and daily food. The pedagogical knowledge includes methods and strategies to promote and encourage understanding and respect of the culture. With the advancement of game technology, games can be initiated for learning cultural awareness. Game-based learning implies self-learning abilities and allows transfer of learning from other cultures. In order to provide an engaging GBL experience, we incorporate the four learning approaches as follows:

- **Narrative-oriented** : It emphasizes the use of storytelling to achieve immersion and drawing on history pedagogy (King and Stahl, 1990). The elements of story-telling include the message, characters and sequencing, plot, the point of view, the story and the experience of the storyteller to be shared as a means of distraction, teaching, safeguarding of culture to introduce values (Hallmeier et al., 2009).
- **Experiential** : Under an experiential model of learning, individuals are encouraged to reflect on their actions and consequences to foster understanding and reapplying this understanding to future actions. In proposing the experiential model, Kolb (1984) put forth a refined definition of learning as "*the process whereby knowledge is created through the transformation of experience*". There are four possible learning styles according to Kolb: (i) Diverging (feeling and watching), (ii) Assimilating (watching and thinking), (iii) Converging (doing and thinking) and (iv) Accommodating (doing and

feeling). This will involve learners to be transplanted into the situations faced by the storyteller, drawing heavily on situative pedagogy (Kolb, 1984; Mayes and de Freitas, 2004)

Table 1: Cultural awareness components in TPACK framework

TPACK	**Cultural awareness components in GBL**
Content knowledge (CK)	*What needs to be conveyed? What are the cultural elements that need to be taught?* Key elements of culture – e.g. languages, food, clothing, visible artefacts, places of worship, home, values, and roles
Pedagogical Knowledge (PK)	*How to teach, promote and encourage understanding and respect of a culture?* Oral history pedagogy, role-play, situative pedagogy, exposure-based, learning environment, socio-cultural, socio-economic status, multicultural education
Technology Knowledge (TK)	*What are the relevant technologies? What are the best tools to use?* Game technology, Game-based learning, Role-play game, Architecture, Game programming, Flow-chart, Virtual environments (VEs)
Pedagogical Content Knowledge (PCK)	*How to convey the cultural knowledge? What are the best ways to represent culture?* Storytelling, storyboard, flow-chart, puzzle, learning environments
Technological Content Knowledge (TCK)	*What technology tools, methods and algorithms can be used to represent the knowledge?* Game-based learning, collaborative, participatory, game development life cycle, Multimedia – images, text, sound, audio, video, 3D, animation, haptic technology, virtual environments (VEs)
Technological Pedagogical Knowledge (TPK)	*How to teach and promote cultural awareness using technologies? What technologies best encourage understanding and respect of the culture?* Narrative-centric, Experiential (role-play), Puzzle-based, Exploratory
Technological Pedagogical Content Knowledge (TPACK)	*How to raise cultural awareness using technology?* Cross-cultural awareness in game-based learning technology

- **Exploratory** : In their model of exploratory learning, de Freitas and Neumann (2009) expand the experiential learning model to include virtual environments (VEs). Exploratory learning opens up the capability for learning through exploration of virtual environments, and using virtuality as an active training dimension. Tied deeply to social interactive learning, the exploratory model aims to provide learning designers with better tools for exploiting three-dimensional VEs. Exploration in this sense

then is a design component that facilitates learning in different ways focusing on ongoing learners' development. In accordance with Vygotskyan theory (Bruner, 1984), learners can be directed to external resources in the context of challenges or problems presented by the games(Mayes and de Freitas, 2004; Arnab et al., 2010b)

- **Puzzle-based** : The emphasis is on providing effective puzzles and challenges for the learner, with the story and narrative taking a less direct role. In order to increase the knowledge about the culture, it is recommended that the story of the game is wrapped around the learning culture content , in which a learner can deal with it directly and step-by-step (Frouschauer et al., 2010).

The motivation of using GBL is thus to gain insight through an engaging and controlled platform that exposes learners to culturally diversified scenarios. Table 1 summarises the underlying cultural knowledge components to be used in GBL based on TPACK framework.

The content in TPACK framework should preserve its own set of values instead of only developing empathy and tolerance. The design attributes are thus to motivate, expose and to provide insight, which advocate experiential and narrative-based learning (King and Stahl, 1990). Life is perceived through others' eyes and a story of an experience is represented in diverse ways.

Based on the TPACK framework, we propose to expand the TPACK by incorporating a third dimension, i.e. the cultural awareness within the *Pedagogy*, *Content* and *Technology* in order to address cross-cultural awareness by integrating GBL in technology enhanced learning (known as CuTPACK). A project is being carried out to explore the potential of an online GBL application that exposes learners to culturally diversified scenarios of the lifestyle of the Iban native in Borneo. Data based on key elements of culture has been collected. We have a corpus of the Iban and the Bidayuh languages, images of artefacts, products, food, clothings/costumes, and typical/traditional abodes. The representation of these content in a GBL should foster an attitude of acceptance and respect for the unique cultures without any biases, anxieties and stereotypes through a series of scenarios that provoke interest, emotion, and insight. We shall incorporate the TPK's four learning approaches within an engaging GBL environment. Similar approach has also been deployed in e-VITA (Arnab et al., 2010b) and ICURA (Frouschauer et al., 2010).

4 Conclusions

Given the advancement in technologies and increasing learners' expectation, teaching and learning is turning to serious games to solve problems; a game-based learning platform will provide an engaging environment to facilitate the transfer of cultural knowledge. Game environments provide a much safer and controlled setting within which players/users can learn new techniques and be exposed to cultural scenarios in a more engaging way. Such intervention taps into a growing trend for serious games targeting audiences who are already engaging with interactive, rich graphic games recreationally, where games can potentially become a new tool to aid their learning, exploration and personal development. The proposed CuTPACK framework appears to cover all the elements necessary to guide the development of a game which helps in raising cultural awareness. Based on a widely used, and accepted framework, we believe that this extended CuTPACK can also be used for the

development of any teaching/learning tools for the international market. Research is being carried out to determine CuTPACK's efficacy in the cultural awareness domain. A positive result would suggest another tool which can be employed to develop culturally sensitive products and services.

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