

# Cultural Influences on Requirement Engineering in Designing an LMS Prototype for Emerging Economies: A Papua New Guinea and Pacific Islands' Case Study

Philemon Yalamu<sup>1</sup><sup>a</sup>, Wendy Doube<sup>2</sup><sup>b</sup> and Caslon Chua<sup>1</sup><sup>c</sup>

<sup>1</sup>*Department of Computer Science and Software Engineering, Swinburne University of Technology, Hawthorn, Victoria, Australia*

<sup>2</sup>*Department of Film and Television, Swinburne University of Technology, Hawthorn, Victoria, Australia*

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**Abstract:** This paper aims to determine from the users' perspective that cultural factors are important in a software development requirement engineering process. It proposes that culture is an important factor in determining the success or failure of a system. Using the design thinking and human-centered approach, a case study to elicit user requirement and a user experiment were done which gathered data from university participants from Papua New Guinea (PNG) and other Pacific island nations. The gathered data was triangulated with four of the six cultural dimensions and three of the five core Requirement Engineering activities that were influenced. The results reveal 11 cultural factors specific to the indigenous culture of participants which were found to have an influence on RE activities; six were related to Hofstede's cultural dimensions while five were unclassified, unique to PNG.


## 1 INTRODUCTION


Requirement Engineering (RE) is a human-centric discipline that is considered a key factor for the development of effective software systems (Arthur & Gröner, 2005; Davis, Hickey, Dieste, Juristo, & Moreno, 2007; Jiang, Eberlein, Far, & Mousavi, 2008). The processes of RE involve rigorous consultations with end-users to identify the needs and requirements of a system (Davis et al., 2007). Scholars have referenced RE to be the most critical and complex process within the development of socio-technical systems (Juristo, Moreno, & Silva, 2002; D. Pandey, U. Suman, & A. Ramani, 2010). Besides, RE is among the main processes that can determine the success or failure of software development (Li, Guzman, & Bruegge, 2015). If the RE practices are poorly planned, it leads to the failure of a project (Agarwal & Goel, 2014; Jiang et al., 2008). As articulated by (Bubenko, 1995; Damian,

2000), one of the main reasons why systems do not meet the expectations of users has been attributed to poor identification of requirements and incomplete requirements. Consequently, to enable its success, RE techniques often accommodate users in the different stages of the design and development process. As in design, users become a central part of the systems development lifecycle, and concepts related to design thinking and human-centered approaches are often employed (Dobrigkeit & Paula, 2019). The context in which RE is achieved depends on cognitive and social acquaintance as a basis for eliciting and modeling requirements (Nuseibeh & Easterbrook, 2000; Thanasankit, 2002). Where social factors exist in any study, culture becomes an aspect to consider.

Culture is one of the factors that determine the RE process as it involves the way individuals behave, think, and interact with systems and products (Kheirkhah & Deraman, 2008). It can be argued that the concept of RE was primarily based on Western culture prior to adopting and considering other

<sup>a</sup> <https://orcid.org/0000-0003-3135-4402>

<sup>b</sup> <https://orcid.org/0000-0001-8066-1199>

<sup>c</sup> <https://orcid.org/0000-0003-3126-3156>

cultures (T Alsanoosy, Spichkova, & Harland, 2018). The essence of culture is important to be considered for the benefit of intended users who will use systems and technologies. RE can be viewed from two perspectives: the developer side and the user side. Most studies have approached RE from the developers' side and from our knowledge, little has been done from the users' end. A previous study highlighted the influences of culture on RE activities from software practitioners and academics (T Alsanoosy et al., 2018). Our study will fill the gap in the literature by presenting RE through the lens of users from their very specific indigenous cultural dimensions.

The main aim of this paper is to determine from the users' perspectives that indigenous cultural factors are important in a software development requirement gathering process. The pragmatism of indigenous culture and practice denotes real-world knowledge pertaining to the know-how (in-practice) than the know-that (on-paper) (Kimbell, 2008, p. 9). Indigeneity (being indigenous) means the root of things or something that is natural/inborn to a specific context or culture. The specificity of indigenous cultures lies around "the ideas, customs, and social behavior of a particular people or society" ("Culture," n.d). More profoundly, the reference to culture in the context of this paper relates to indigenous knowledge and practices of students within Papua New Guinea (PNG) and other smaller Pacific Island nations as emerging economies, which are the populace for the studies discussed in this paper.

The inspiration for this paper originates from previous studies related to cultural influences on RE activities (T Alsanoosy et al., 2018; Tawfeeq Alsanoosy, Spichkova, & Harland, 2019; Hanisch, Thanasankit, & Corbitt, 2001; Heimgärtner, 2018; Rahman & Sahibuddin, 2016). These works have provided insights and understandings on culture and the RE process particularly for web technologies undertaken for higher learning in developing nations.

The paper is structured as follows: Section 2 discusses related works on RE for the web including cultural influences. Section 3 outlines the methodology used in the paper. Section 4 presents the results and provides discussions and implications. Finally, section 5 presents the conclusion of the paper with plans for future work.

## 2 RELATED WORK

This section presents studies done by other scholars on requirement engineering as the prevailing

principle for systems that support web technologies for learning in developing nations and pays specific focus on culture.

RE is the first phase of the software development life cycle and is considered the foundation of any software product (Malik, Chaudhry, & Malik, 2013).

Many studies capture the RE process highlighting several stages and among those, are the five fundamental (sub) processes (Abran, Moore, Bourque, Dupuis, & Tripp, 2004; D. Pandey, U. Suman, & A. K. Ramani, 2010; Sawyer & Kotonya, 2001; Sommerville, 2011): requirements elicitation, requirements analysis, requirements specifications, requirements validation, and requirements management. For this paper, more emphasis will be on the following: requirements elicitation, analysis, and validation since requirements specifications and management were not part of our study. Figure 1 shows the RE process used for this paper, highlighting the user and developers' activities.

This study is also guided by the international standard that manages the RE process. The standard ISO/IEC/IEEE 29148:2011 provides the standard guideline for the process and activities for RE.

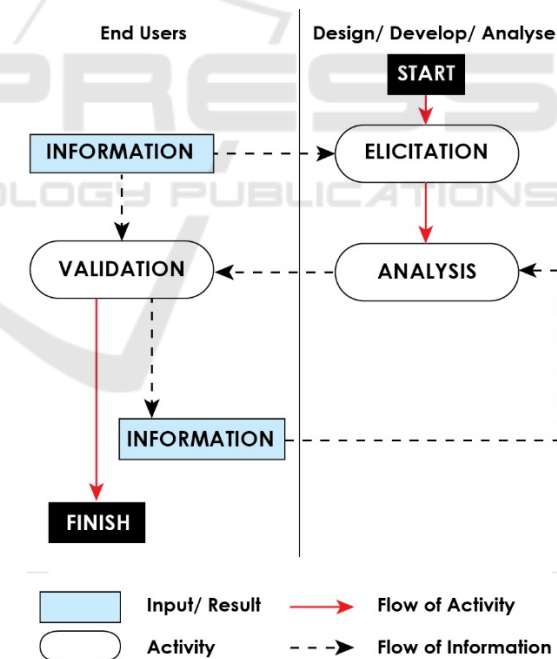


Figure 1: The RE Process for the study.

## 2.1 RE Activities

### 2.1.1 Elicitation

In RE, requirements elicitation is one of the primary activities that attempt to define the project scope and

elicit user requirements (Khan, Dulloo, & Verma, 2014). This stage defines the process to understand a problem and the contexts of its application (Kasirun, 2005). According to Kasirun (2005), the purpose of requirements elicitation is to gather as many requirements as to enable alternative solutions for problems at hand. Oftentimes, the success of the requirements elicitation activity provides better outcomes on the goals set for RE, resulting in the development of the appropriate and effective application (Kasirun, 2005).

### 2.1.2 Analysis

The reason for doing the Requirements Analysis Process was to get the views of the stakeholder on the requirements of desired services and turn it into a technical view of a required product that could deliver those services.

This process creates an impression of a system that will satisfy stakeholder requirements in the future, and that, as far as limitations allow, does not suggest any specific implementation. It brings about quantifiable framework necessities that determine, from the supplier's perspective, what qualities it is to have, and with what extent to fulfill stakeholder prerequisites.

### 2.1.3 Validation

This activity validates the requirements for realism, consistency, and completeness. It is the stage in RE where errors are usually identified in the requirements document. If problems are identified, they must be modified and corrected. Requirements validation is dependent upon endorsement by the project authority and key stakeholders. This process is raised during the stakeholder's requirements definition process to ensure the requirements accurately reflect the stakeholder needs and to establish validation criteria, to ensure the right requirements were captured. System validation checks to ensure the designed system satisfies the needs and requirements stated by the stakeholder. For our study, we have used a Learning Management System (LMS) prototype that was tested and validated by students as stakeholders.

## 2.2 RE for the Web

The RE process has widely been employed in numerous systems and applications including the web. There are, however, indistinct engineering approaches to the development issues for the web (Pasch, 2000). According to Overmyer (2000), there

are some variances between the development of traditional software and web application that may agitate the conventional requirements engineering fundamentals. As contended by M. Jose Escalona and Koch (2004); Srivastava and Chawla (2010), web applications encompass numerous stakeholders, and the size and purpose of the applications differ as well. Previous studies have proposed several methodologies with processes, models, and techniques to build web applications (M. J. Escalona, Mejias, & Torres, 2002; Koch, 1999; Retschitzegger & Schwinger, 2000). Although these models could work for some, they may not satisfy others because of the differences in user requirements that countries have. Particularly for emerging economies, Internet access continues to significantly increase broadening access and enabling opportunities (Poushter, 2016). This change allows sectors such as education to integrate web applications and systems into their learning. Since web technology can eliminate barriers in education (Vegas, Ziegler, & Zerbino, 2019), learning institutions in emerging economies such as PNG and other Pacific Island countries (PICs) are determined to adopt technologies such as LMS to aid teaching and learning.

Since the PICs face numerous geographical complexities, their islands scattering across the ocean, and other infrastructural impediments, the use of LMSs would allow learning resources to reach out to its citizens. While access remains notable, numerous end-user requirements could pose challenges for software developers and designers (Garnaut & Namaliu, 2010; Gunga & Ricketts, 2007; Kituyi & Tsubira, 2013). Among those challenges is culture, which is considered to be one of the factors for effective learning (Chen, Mashhadi, Ang, & Harkrider, 1999).

Within PICs, culture is considered an integral part of society. Consequently, for web technologies to be adopted, cultural factors should be considered in the RE process.

## 2.3 Cultural influence on RE Activities

Culture plays an important role in influencing how people and companies operate including their preferences on techniques, methods, and practices used in RE. It conditions how people think, communicate, understand, and select what is important (Hofstede, Hofstede, & Minkov, 2010). There are distinctive beliefs, customs, and approaches to communication that differs from every culture. This diversity is influenced by the behavioral practice within these cultures. According to Hanisch et al.

(2001), the social and cultural factors of RE affect the success of software development and therefore cannot be ignored. Earlier work done on the influence of culture on RE activities shows a correlation regarding the impact of the cultural background from Saudi Arabia's perspectives, on RE practice (T Alsanoosy et al., 2018).

### 2.3.1 Hofstede's Cultural Dimensions

Hofstede et al. (2010) conducted one of the most comprehensive studies of how values in the workplace are influenced by culture. This study has been widely used in various domains including RE. According to Hofstede (2009); Hofstede et al. (2010), culture is defined as "the collective programming of the mind distinguishing the members of one group or category of people from others". Hofstede et al. (2010) proposed to focus on six dimensions of a nation's culture and those include:

- **Power Distance Index (PDI):** The degree to which the less powerful members of an organization or group accept and expect that power is distributed unequally, such as in a family or school setting.
- **Individualism versus Collectivism (IDV):** The degree to which people within a society collaborate with each other; Thus, highly individualistic societies would encourage individual authority, achievement, and give the power to make individual-decision. Individualism is the extent to which people feel independent, as opposed to being interdependent as members of larger wholes.
- **Masculinity versus Femininity (MAS):** The degree to how social gender roles are distinct and in particular for masculinity where the use of force is endorsed socially.
- **Uncertainty Avoidance Index (UAI):** The extent to which society members feel either uncomfortable or comfortable in chaotic or confusing situations. UAI deals with uncertainty and ambiguity.
- **Long- vs. Short-term Orientation (LTO):** The extent to which people within a society are connected to their own past while dealing with the present and future challenges.
- **Indulgence versus Impulses (IND):** The degree to which people within a society have fun and enjoy life without restrictions and regulations. It infers long-term orientation to deal with change.

With this model, each country has a numerical score using the above dimensions to define the society of

this country. The score ranges from 0 – 100 and has 50 as the average. Hofstede's rule outlines that if a score exceeds the average of a cultural dimension, then it signifies the culture to be high on that dimension. Hofstede's model only included some of the larger economies, however, highlighted some similarities between national cultures.

### 2.4 Requirements of LMS

LMS is an e-learning platform for delivering learning resources (Lawless, 2019) and is used by education providers such as higher learning institutions (HLI) to deliver all the courses they offer to their students. In PNG, not all HLIs have fully utilized LMS until recently after the disruption of COVID-19. For those PNG HLIs that have been using it, their focus was often too generic on improving 'access to information communication technology' or providing 'alternate learning method' for students. For many PNG students today, there is a trend where they carry their mobile devices and expect information to be available to them anywhere at any time.

For our study, we elicited user requirements for learning technologies used in PNG higher learning institutions to gather teaching and learning experiences from students, lecturers, and university administrators. We also investigated traditional influences in learning that affects their learning. These were done using a case study which determined students' preferences for technology.

Results uncovered are further used to identify other lms requirements associated with PNG's traditional culture.

## 3 METHODOLOGY

This section presents the design of the methodology and procedures used in the study. To achieve the objectives of our study, we conducted two user studies during the requirement gathering phase in the design of the LMS prototype. These user studies are to determine whether indigenous cultural factors are important in a software development requirement gathering from the perspective of the users. These user studies incorporated survey questionnaires, semi-structured interviews, focus groups, observations, and with literature review. The user studies and their objectives include:

- **Exploratory Case Study (S1):** To elicit user requirements for technological solutions for teaching and learning.

- **User Study (S2):** To validate requirements gathered from the case study.

S1 was conducted with participants studying and working at a university in PNG. The data was collected from questionnaires ( $n=58$ ), focus groups ( $n=15$ ), and interviews ( $n=2$ ). S2 was conducted with participants from PNG and other smaller Pacific island nations as emerging economies, studying in various universities in Victoria, Australia. Data collection was done through questionnaire ( $n=22$ ) and observations ( $n=22$ ). The ‘ $n$ ’ represents the number of participants who completed the study using respective data collection methods.

Using the human-centered approach, we gathered user requirements from the participants in S1 and S2. Following the RE process highlighted in Figure 1, we completed the two studies.

In S1, we investigated various teaching and learning experiences from university participants in PNG. The findings point to infrastructural and administrative challenges, common to other emerging economies. Besides, there were other cultural influences related to traditional knowledge and practices identified from this study. These requirements were gathered from the questionnaire and focus groups.

The user requirements in S1 were analysed and transformed into a technical view of a required product and in this case, an LMS prototype. In the LMS prototype, we incorporated the cultural influences into three categories: language, symbols, and motifs (Yalamu, Chua, & Doube, 2019; Yalamu, Doube, & Chua, 2020). A set of tasks were designed for participants to follow. Following this, we designed a working prototype of an LMS in S2 where the cultural influences identified in S1 were incorporated into the LMS. Then a user study was done using the designed LMS prototype and tested on PNG, and Pacific Island students from Fiji and Solomon Islands, studying in Australia to confirm and validate whether we have captured the right requirements.

Hofstede’s cultural dimensions presented in section 2.2.1 provide the framework for cultural requirements generated from our two user studies.

## 4 RESULTS AND DISCUSSION

The two separate user studies that were carried out with PNG and other Pacific Island students from the contexts of emerging economies, gathered insights on teaching and learning experiences and the importance of culture in which varying RE activities were influenced by some of the indigenous cultural factors.

The data for S1 highlight how culture influences learning style; e.g: from the focus groups, we asked, ‘Can you think of any ways in which traditional culture affects the ways students communicate with each other and with their lecturers at your university?’ Responses from students highlighted factors such as ‘teachers are considered elders, therefore are respected and cannot be questioned. Besides, data from S2 (Yalamu et al., 2019) highlights how culture is valued by students; e.g: from all the comments made relating to participants’ perception on interacting with the LMS prototype interface, 64% of PNG students mentioned comments related to cultural symbols giving them a sense of identity, pride and belonging. These are two of the examples from our studies. Based on the summary of results conducted in these two studies, 11 cultural factors specific to the indigenous culture of participants were found to have an influence on RE activities and those include:

1. Local language for learning
2. Bigman system (e.g: *man has high status*)
3. Hereditary (e.g: *patrilineal and matrilineal*)
4. Wantok system (e.g: *Favouritism in class*)
5. Respecting teachers as elders
6. Gender preference for group collaboration
7. Learning styles
8. Knowledge transfer happens between the same gender
9. Students do not speak up
10. Making mistake denotes stupidity
11. Cultural symbols – gives a sense of pride, identity, and belonging

These cultural influences were grouped into five cultural categories, four were derived from Hofstede’s dimensions: (power distance, collectivism, masculinity, short-term orientation and introduced a new dimension unique to PNG as Specific. Table 1 shows the influence of PNG culture on the main activities within the RE process. The “✓” indicates that the corresponding cultural dimension is influenced by the corresponding RE activity whereas the “-” signifies that the corresponding cultural dimensions do not apply to the corresponding RE activity.

Table 1: Influences of Cultural dimensions on RE activities.

RE Activity	Hofstede’s Cultural Dimensions				
	PDI	IDV	MAS	STO	Specific
Elicitation	✓	✓	✓	✓	✓
Analysis	✓	✓	✓	-	✓
Specification	-	-	-	-	-
Validation	✓	✓	-	-	✓
Management	-	-	-	-	-

Two of Hofstede's cultural dimensions: The Uncertainty Avoidance Index (UAI) and Indulgence versus Impulses (IND) have been excluded. This is because none of the data gathered has any cultural factors from PNG that influences or has any relationships with them. In place, a specific cultural influence has been added. This was added to cater for some of the cultural influences that were not captured by Hofstede's cultural dimensions and are unique to PNG.

## 4.1 Cultural influences on RE

Hofstede's cultural dimensions (Hofstede, n.d.; Hofstede et al., 2010) unfortunately does not include all the emerging economies such as the smaller Pacific island nations including PNG. Despite this, there are few identical characteristics similar to those presented by Hofstede. PNG, being in Melanesia, shares a lot of cultural similarities with many African and some Asian countries.

### 4.1.1 Power Distance Index

As mentioned above, Melanesian culture is similar to many African and some Asian countries in which PNG and other smaller Pacific Island nations come under. Presented below are the 11 cultural influences from our S1 and S2 user studies that relate to the cultural dimensions.

In countries with high PDI, showing respect for teachers and elders is considered a basic and lifelong virtue (Hofstede et al., 2010). We place PNG and the Pacific island nations as ranging within the high PDI category.

**Respecting Teachers as Elders:** According to Hofstede et al. (2010), teachers are respected or even feared, and sometimes, students may have to stand when teachers walk into the classrooms. The data from our survey showed comments from student participants that relate to this where students find it difficult to criticise their teachers because of the way they grew up respecting their parents and elders in their villages. Hofstede et al. (2010, p. 69) highlight, "students in class speak up only when invited to; teachers are never publicly contradicted or criticized and are treated with deference even outside school". Besides, student participants in the focus group also highlighted that a way to respect their elders was to keep a low profile and be humbled so they can avoid challenging their teachers.

**Students Do Not Speak up in Class:** Hofstede et al. (2010) highlighted that classroom situations often involve strict order, with the teacher initiating all

communication. Students only speak up in class when they are invited. Teachers do not get public criticisms and are often treated with deference even outside school. In our study, similar statements were expressed and one of which, a lecturer participant in the focus group highlighted that "...students do not speak up when asked to. This is linked to traditional connotations whereby their thoughts are expressed by an elder or a village representative".

### 4.1.2 Collectivism

PNG, like other Melanesian islands, can be categorised as a Collective society due to the fact they live in traditions, consisting of a living society of men, sharing a common life as a member of the community (Denoon & Lacey, 2017). Collectivism refers to "societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for unquestioning loyalty" (Hofstede et al., 2010).

**Wantok System:** Data from the user studies show a range of wantok systems being practiced that would influence RE activities. Participants mentioned issues such as lecturers and students with common relationships support each other academically. Other times, it helps get people together for a common good. For example, a participant explained, "...the wantok system brings us together to live and care for each other's' needs and even protects each other during times of need or when facing attacks". This system often comprises relationships between individuals characterised by certain aspects like a common language, kinship, geographical area, social association, and belief and it is one that is often regarded as vital in traditional PNG societies (Renzo 1999, as cited in Nanau, 2011).

### 4.1.3 Masculinity

Our user studies revealed the **bigman system** where a **male has a higher status** than female counterparts in PNG context. The bigman system resembles a type of leadership role where males, have certain personal qualities and status that are reflected in their character, appearance, and manner, enabling them to have power over others within their society (Sahlins, 1963). The *bigman* system is built around respect and regard to the *bigman* for being the most respected person of worth and fame (Nanau, 2011). Supported by Hofstede et al. (2010), "Men are supposed to be more concerned with achievements outside the home – hunting and fighting in traditional societies. They are supposed to be assertive, competitive, and tough.

#### 4.1.4 Short-term Orientation

Short-term orientation stands for the “fostering of virtues related to the past and present – in particular, respect for tradition, preservation of ‘face,’ and fulfilling social obligations” (Hofstede et al., 2010, p. 239).

**Hereditary Statuses:** Data from our user studies show students and lecturer participants mentioned factors related to socio-cultural issues around the hereditary status of men and women. This is a form of a culture where people keep their traditions and preserve certain practices to fulfil the social obligation (Hofstede et al., 2010). In specific contexts, PNG societies have the unilineal descent system which comprises of patrilineal and matrilineal societies, where men from patrilineal backgrounds inherit the land and other family obligations while from matrilineal, female owns the land and all other obligations.

#### 4.1.5 Specific Cultural Influences

Apart from Hofstede’s cultural dimensions model, this study identified four cultural influences that are specific to PNG’s indigenous cultures and those are: local language, gender preference, and learning styles.

In countries with high PDI, showing respect for teachers and elders is considered a basic and lifelong virtue (Hofstede et al., 2010).

**Local Language for Learning:** The issue of language was considered to be an essential cultural factor that affects students learning. Although English is an official language taught in schools, participants expressed that it sometimes becomes difficult to understand, especially when it is the third, fourth, or fifth language for many. PNG has over 800 languages and it would be extremely difficult to include all the languages in the RE process and systems. However, there are four official languages and among those, *Tok-Pisin* is regarded as the widely spoken language throughout the country (EMTV Online, 2015; Malone & Paraide, 2011; Paliwala, 2012; The Economist, 2017).

Besides, participants also used *Tok-Pisin* while attempting the surveys and focus groups and claimed that students and lecturers are speaking *Tok-Pisin* during course discussions when confronting situations where English could not be clearly understood.

**Gender Preference:** In the Likert-scale survey questions, female participants rated a higher

preference for collaboration in any learning activity with their same gender instead of the opposite gender.

**Learning Styles:** There were also several responses relating to learning styles such as the suggestion that traditional learning was done through observations, storytelling, and practice-based. For instance, during the focus group discussion, one of the participants said, “*learning is done through creative means by telling stories, arts and crafts and performances*”. Besides, a comment on the gaming experience suggests that the game simulates practice-based learning which is similar to traditional learning and engages participants. Moreover, a participant mentioned that people are hesitant to attempt new challenges in fear of the notion that those who make mistakes are seen as being stupid and do not know anything.

**Cultural Symbols:** Participants reflected on materialistic objects of culture claiming they have a certain degree of significance to their perceptions and emotions. For instance, in the user study, a student participant outlines, “*...having cultural icons/ motifs is another way of preserving culture by incorporating them in the interface...The icons are symbols and respectable ornaments that are used by culturally signifying cultural standing and elevation*”. Another added, “*Traditional learning is always done in a playful and engaging way. For instance, we learned to build houses by using clay and sticks, that basic knowledge provides the fundamental idea of building a proper house*”.

**Knowledge Transfer:** Data from our user studies revealed that knowledge transfer is often imparted between the same gender either from an elderly male to a young male or an elderly female to a young female. For instance, a participant said, “*...elders coached youths in the villages through various cultural activities*”. Another added, “*traditional knowledge is imparted through oral, visual and hands-on activities which have interaction with the elders*”.

## 4.2 Implications of the Study

This study shows that the current RE practices often missed perceptions of users regarding their cultural influences that could affect the RE processes, particularly those users who come from indigenous cultures, which are often considered sensitive. It is important for requirements analysts and researchers, to be more culturally conscious of cultures that are sensitive during the RE process. This would require adequate research around indigenous people and their

culture, which will inform people to be mindful when engaging in the RE process.

## 5 CONCLUSION AND FUTURE WORK

RE is a human-centric and socio-technical process fundamental to every software project. The process involves sensitivity to the users' cultures and requires a clear understanding of user requirements. As such, attention to the user's culture is necessary. In places that regard culture as an integral part of everyday life, the RE process should consider cultural-sensitivity.

This paper gathers insights from participants through two user studies on cultural influences of teaching and learning from university students from PNG and other smaller Pacific Island nations within the emerging economic sector. In S1, a requirements elicitation was conducted with university participants from PNG in PNG. The requirements in S1 were analysed and an LMS prototype was designed. In S2, this LMS prototype was validated by PNG and Pacific Island students studying in Victoria, Australia. The gathered data was triangulated with four of the six cultural dimensions and three of the five core RE activities that were influenced.

The results reveal 11 cultural factors specific to the indigenous culture of PNG which were found to have an influence on RE activities. This supports our objective that culture is essentially important in the RE process and that users' perspectives are critical to determining progressive RE activities. Six of these influences were related to Hofstede's cultural dimensions while five were unclassified, unique to PNG.

Following this study, future work will expand the scope of this paper to cover the influence of indigenous culture on RE activities from the contexts of PNG and other smaller Pacific island states through the lens of software practitioners and academics. This will involve directly investigating the influence of indigenous culture on RE activities from the contexts of PNG and other smaller Pacific island states through the perspectives of software practitioners and academics. For instance, identifying localisation challenges pertinent to software design and development practices and how indigenous knowledge, culture, and tradition contribute to informing decisions that software practitioners and academics make in the RE process.

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