Chapter 2
Cultural Consciousness in Heritage Architecture Education With a Problem-Based Learning Approach

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ABSTRACT

Heritage architecture education is important to develop contextual understanding and cultural consciousness among architecture students. Conventional teaching approaches are inadequate to cultivate students' cultural knowledge of specific places and community contexts. This chapter addresses this gap by evaluating how problem-based learning (PBL) as a teaching approach in a measured drawing module contributes to cultural consciousness among architecture students. It adopts quantitative survey research design to evaluate students' cultural consciousness based on knowledge of place identity, understanding of community social contexts, and recognition of community cultural contexts. Two student cohorts completing the module participated as respondents, providing insights into PBL's impact. The findings substantiate the adoption of PBL as an effective pedagogy to enhance students' cultural consciousness, by developing contextual and cultural sensitivity in design cognition. It is also useful in guiding the design of teaching approaches for culturally related subjects in other disciplines.

INTRODUCTION

Architecture plays a significant role in reflecting the cultural identity and history of a place and its community. This encompasses various aspects of building design which should consider local environmental factors and meet the needs of the people while respecting the values and traditions of the com-

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munity. The International Union of Architects (Union Internationale des Architectes) acknowledges this significance and envisions a diverse and inclusive architectural education that recognises human, social, cultural, urban, architectural, and environmental aspects as outlined in the UNESCO-UIA Charter for Architectural Education (UIA, 2023). It is therefore crucial for architectural students to learn about the significance of each place and features of local socio-cultural importance. However, the current approach to architectural education tends to prioritise universal and global values, often neglecting local and regional significance (Gunewardene, 2016). Olweny (2020) suggests a shift of focus on local contexts when developing architectural education curriculum. Embaby (2014) argues that both the universal and local values of place and community should be comprehensively integrated, rather than being treated as separate entities. Recognising this, the UNESCO-UIA Charter for Architectural Education emphasises the role of architectural heritage education in developing knowledge of sustainability, resilience, social contexts and sense of place in building design. This would nurture design thinking for creative approaches in addressing the transformation of cultural process (UIA, 2023, p3).

Although the significance of cultural heritage has been recognised in the architectural education framework (Clarke et al., 2020; Djabarouti & O'Flaherty, 2019; Jadresin Milic & Nikezic, 2018; Lapadula & Quiroga, 2012), related subjects such as architectural history receive little attention from educators, because they are separated from the architectural design domain (Li, 2018). Pasha (2020) reports that the role of culture in architectural education is over-simplified and reduced. Furthermore, current approaches to teaching architectural history remain limited in achieving the desired outcomes. Li (2016) asserts that architectural history courses have been marginalised compared to architectural design courses in academic institutions. Inadequate teaching time hinders the effective delivery of the course. In addition, an over-reliance on lectures as the primary teaching method leads to passive learning among students, reducing their engagement with the subject. Embaby (2014) argues that conventional teaching of architectural history often neglects its practical applications, overlooking the crucial link between cultural heritage and architectural education. This highlights the need for educators to recognise the importance of incorporating cultural heritage as an integral part of a holistic architectural curriculum, without discriminating against other aspects.

ADDRESSING THE NEED FOR A PROBLEM-BASED LEARNING APPROACH

As scholars generally agree that local values should be given equal respect in architecture education, it is considered important to adopt a place-based approach in understanding the contexts that constitute these values. Ng (2013) observes that placing emphasis on contexts enables students to cultivate sensitivity towards a place while also expanding design creativity. Similarly, Nikezić & Marković (2015) have highlighted the value of place-based learning in enhancing students' awareness of spatial-cultural contexts, thereby influencing their environmental literacy and developing a sense of responsibility. However, conventional teaching approaches towards heritage architecture education often adopt a generic learning scope that lacks real-world contexts involving specific places, communities, and cultural systems. This may not sufficiently engage students in developing a deeper cultural understanding of unique places and community contexts.

In response to this, Smith & Sobel (2004) suggest a learning process that emphasises the connections between place and society, allowing real issues affecting specific localities and communities to be addressed. Consequently, an effective educational approach in heritage architecture should integrate a

problem-solving framework, incorporating Problem-Based Learning (PBL) to develop students' ability to address real issues related to place and society.

According to Bigelow (2004), PBL is an instructional method that uses problems to help students develop problem-solving skills and acquire basic knowledge. Guerra & Kolmos (2011) define PBL as an inquiry process where students work on real and complex problems that guide their learning. Banerjee & Graaf (2010) describe PBL as a shift from traditional teaching to a student-centred approach that integrates different subjects and skills through thematic curriculum design. Alhassan et al., (2020) describe PBL as a student-centred approach focusing on interactive and identity-directed learning while incorporating background knowledge and skills. In PBL, the role of the instructor changes from that of a knowledge provider to that of a facilitator of the learning process (Guerra & Kolmos, 2011), allowing students to acquire knowledge through problem-solving. Place-based learning is rooted in PBL (Alhassan et al., 2020, p.74). As demonstrated in studies by Curto et al. (2021) and Valentín-Gamazo et al. (2021), place-based learning in heritage architecture can benefit from PBL to achieve the intended learning outcomes.

While PBL has been widely adopted across various disciplines, its application in heritage architecture education has been relatively limited. Consequently, there is an urgent need for research into the integration of PBL into the curriculum and methodology of heritage architecture education. This paper aims to bridge the gap identified in conventional heritage architecture education pedagogy, by examining how the PBL instructional approach used in a measured drawing module facilitates the development of students' cultural consciousness.

THE CULTURAL CONSCIOUSNESS FRAMEWORK IN ARCHITECTURE

In a broad sense, culture refers to the beliefs, traditions, way of thinking, religion, and lifestyle of a social group. This encompasses the cognitive processes that define the values and behaviour of a group (Hessam & Sotoue 2016). Culture is viewed as a holistic concept collectively shared by a society, including both tangible and intangible aspects, and has the ability to change and develop over time (Pasha, 2020, p.113). The relationship between culture and architecture has been extensively studied. Architecture serves as a tangible manifestation of a society's collective consciousness, expressing and communicating its ideas, values, and beliefs (Hendrix, 2010). This has a profound impact on architectural representation. Architecture involves the interdisciplinary understanding of culture, including the study of material culture and spatial cultures, and focuses on the transformative process of creating and cultivating human living spaces within the environment (Troiani et al., 2013). According to Rapoport (2005), culture functions as a "design for living" that guides the way of life and provides a framework for understanding the patterns and structures of a society. It also serves to distinguish and highlight the differences between social groups. The impact of culture on architecture is strongly evident, with values, practices, activities strongly influencing the design of contemporary human inhabitation (Al Husban et al., 2021).

Recognising the importance of cultural diversity is essential, as stated in the Universal Declaration on Cultural Diversity by UNESCO. This declaration emphasises that cultural diversity should be seen as a shared heritage and valued for the benefit of present and future generations (UNESCO, 2002). One must be culturally conscious to appreciate cultural diversity. Cultural consciousness refers to the process of developing an understanding and awareness of different cultures, which can lead to a deeper

knowledge and appreciation of other individuals and contexts (Páez & Albert, 2012). This also fosters the development of respect and tolerance towards cultural diversity (McKeen, 2019). As architecture is closely linked to human societies, cultural consciousness offers a perspective to understand architecture based on cultural parameters, which will foster appreciation towards the embodied values held by both historical and contemporary societies. Many studies have emphasised the importance of preserving cultural heritage with cultural consciousness, which plays a vital role in achieving cultural sustainability (De Merode et al., 2004; McMINN & Polo, 2005; Jokilehto, 2007; Postalcı & Atay, 2018). Therefore, incorporating a cultural consciousness framework into architectural study is crucial. Rapoport's framework on the cultural dimensions of architecture makes a significant contribution in this regard.

Rapoport's framework incorporates cultural and social variables into the built environment. Social variables include family and kinship structure, social networks, roles, statutes, social institutions (Figure 1). Cultural variables involve specific values derived from a particular worldview, expressed through ideas, images, and meanings. These values shape people's lifestyles and result in a set of defined activity systems. The activity system then influences the design of the built environment, including the organisation of space, time, meaning, and communication, as well as the features of the cultural landscape. Culture in architecture can be seen as the physical manifestation of a society's values (beliefs, traditions, religion) in the environment (buildings and landscape), accommodating the specific activity systems expressed through social variables (family and kinship structure, social networks, roles, statutes, social institutions, and so on).

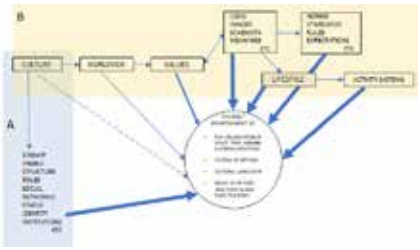
From this framework, the physical manifestation of the environment indicates the place, where one can experience the landscape and see the buildings. Social variables and society values constitute a place's social contexts. Values and the activity system suggests the cultural contexts associated with a place. By categorising these elements, we can derive the cultural consciousness attainment parameters, as shown in Figure 2. A person's cultural consciousness of a place can be measured by three indicators, namely knowledge of place identity, social contexts of the community understanding and recognition of cultural contexts of the community.

Place identity knowledge acquisition involves the perception of meanings associated with a spatial setting, determined by the physical environment and human values (Chen & Xu, 2017). It also encompasses a sense of distinctiveness that sets a place apart from others, while maintaining a continuity of self-conceptualization over time (Morel-EdnieBrown, 2012. Factors such as history, daily activities, shared memories, physical features of the site, architectural styles, historical events, and traditional businesses contribute to the cognitive understanding of a place's identity.

Context refers to any components which may characterize the situation of an entity, relevant to the interaction between a user and a situation (Dey, 2001). Social contexts therefore include social variables that generate meanings specific to the users in relation with their interaction with groups of people. Understanding a community's social contexts involves understanding the kinship, family units, organisational structure, and social network related to the users.

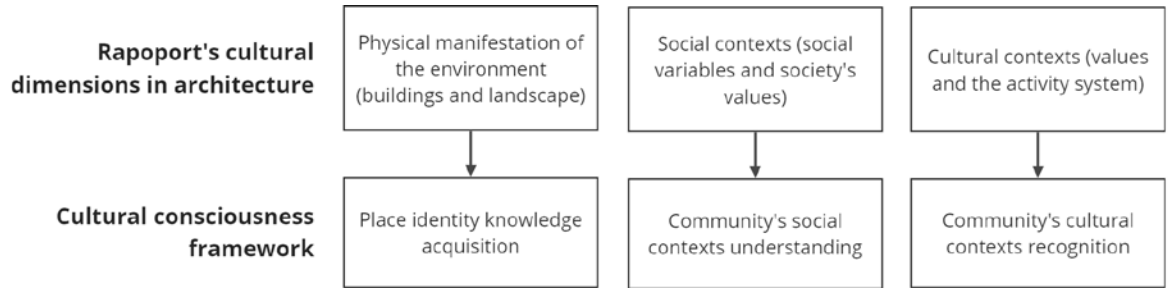
A community's cultural contexts recognition refers to the values and activity systems of the community. Values may be indoctrinated through faiths and beliefs, which have significant effects on lifestyle through religion, customs, art, food, clothing, language and other factors as the ideal images or schemata that define the activity system. Examples of such activities include prayers, rituals, consecration of ancestors and gathering of community members.

Figure 1. Rapoport's framework of cultural dimension in architecture



Rapoport (2005)

Figure 2. Derivation of the cultural consciousness framework from Rapoport's framework of cultural dimensions in architecture



Source: Authors (2023)

MEASURED DRAWING AS PROBLEM-BASED LEARNING INSTRUCTIONAL APPROACH IN HERITAGE ARCHITECTURE EDUCATION

Measured drawing is a method adopted in heritage documentation, a part of architecture heritage conservation process. Its importance lies in providing valuable insight into historical significance, documenting conditions, interpretation, and guiding conservation efforts (Andrews et al., 2010). Warden & Woodcock (2005) emphasise the significance of history and pedagogical values offered by historic architecture documentation. This enhances students' observational skills to develop three-dimensional understanding of the building, and allows them to accurately describe the building and appreciate its craftmanship.

Measured drawing is taught in many institutions as a learning approach in heritage architecture education. Akboy-İlk (2017) defines measured drawing as a formalised documentation product that records existing conditions of the building's architectural setting after it was constructed, enabling students to learn about the architectural contexts and expression of cultural values by analysing and interpreting the

local environment, social and cultural settings. This involves fieldwork study within specific localities and communities, which leads students to address real problems defined under the framework of PBL.

The instructional approach of measured drawing is designed to address three defined problems: place identity, social contexts, and cultural contexts. It involves documenting the physical and non-physical attributes of identified heritage buildings. The working process begins by identifying a place or community with heritage and historical significance. Fieldwork is carried out by the students in a group. Site analysis is conducted to understand the tangible and intangible characteristics of the place and community. The documentation of buildings involves physical measurements and historical data collection through interviews, photography and archive materials review. Findings of the documentation are presented in the form of architectural drawings produced using Building Information Modelling (BIM) software, a scale model and a report. Acquired knowledge is disseminated and shared through exhibitions and sharing sessions organised with the local communities.

This process aligns with the PBL process involving five stages as proposed by Schechter (2011), shown in Table 1. The first and most essential stage involves problems identification. This shall introduce students to the complex, real-world problem within as specific context acting as learning stimulus. At this stage, students will identify, reframe and analyse the problems to generate hypothesis and derive learning goals. This requires students to define the real-world problems in heritage architecture learning: place identity, social contexts, and cultural contexts of the selected place and community. In Stage 2, students will engage in the process of problem-solving by actively seeking information. Using measured drawing, students will identify both tangible and intangible attributes of a place and create a plan for conducting fieldwork. Once on-site, they will select appropriate techniques for measuring, choose reliable resources for data collection from individuals or institutions, and utilise efficient methods for producing drawings. In Stage 3, students are required to generate and test the solutions, supported by data and existing research, using on-site measurement, interviews, photographic documentation, and the study of archive materials. The solution also incorporates collaborative cloud-based 3D modelling using BIM software and a physical scaled model creation. In Stage 4 students are required to review and appraise the findings, which involves reviewing the progress of 3D modelling and coordinating it using the BIM 360 cloud service application. Report findings are reviewed using the Google Drive application. In Stage 5, students engage in reflection on their learning experience and share the outcomes, through exhibition of physical scaled models, drawings, and reports. Additionally, they also participate in seminars and knowledge-sharing sessions to disseminate their acquired knowledge and experiences.

Table 1. Specifications of tasks involved in measured drawing module's PBL instructional approach

PBL Stages	Description	Specification of Tasks in Measured Drawing Module
1. Identify Problems	Define the problems	• Define place identity • Define social contexts • Define cultural contexts
2. Develop Solution Strategies	Identify what are needed to solve the problems	• Identify place contexts • Fieldwork planning • Determine appropriate measuring techniques • Select relevant individual/ institution and reliable resources for data collection • Identify efficient 3D modeling methods
3. Execute Solution Strategies	Make and test the best solution	• On-site measurement • Interviews, photography documentation and study of archive materials • Collaborative cloud-based 3D modeling using BIM software • Physical scaled model creation
4. Finding Review & Evaluation of Results	Appraise and review the findings	• 3D modeling progress monitoring and coordination review using BIM 360 cloud service application • Cloud-based report findings review using Google Drive application
5. Outcomes Sharing	Reflect on learning experience and share the outcomes	• Exhibition of physical scaled model, drawings and report • Seminar and sharing session

RESEARCH METHODS

This research investigates the cultural consciousness attainment of students who experienced the measured drawing module as part of the heritage architecture education. Quantitative survey research allows examination of specific aspects such as demographic features, behavioural displays and attitudes of an identified population. An online survey research design was adopted to measure architecture students' cultural consciousness acquisition of place identity knowledge, community's social contexts understanding and community's cultural contexts recognition through the PBL instructional approach adopted in the measured drawing module.

It seeks to answer the following research questions: (1) Will the PBL instructional approach of measured drawing module enable students' acquisition of place identity knowledge? (2) Will the PBL instructional approach of measured drawing module significantly affect students' understanding of the community's social contexts? (3) Will the PBL instructional approach of measured drawing module significantly affect students' recognition of the community's cultural contexts? The research questions lead to formulating three hypotheses as follows:

Hypothesis One H1: The PBL instructional approach adopted in the measured drawing module will have significant effects on students' acquisition of place identity knowledge.

Hypothesis Two H2: It is expected that the PBL instructional approach adopted in the measured drawing module will have substantial effects on students' understanding of the community's social contexts.

Hypothesis Three H3: It is likely that the PBL instructional approach adopted in the measured drawing module will significantly affect students' recognition of the community's cultural contexts.

The subject information in Table 2 shows a sample of 40 students who have completed the measured drawing module. Cohort X comprises 47.5% of the total respondents, who were tasked with documenting heritage buildings in Klang, Malacca, Kedah, and George Town, Penang. The heritage buildings encompass traditional Chinese shophouses, a traditional Chinese temple, a traditional Malay house, Malay palace, and church. The remaining 52.5% of respondents belonged to cohort Y and are focused on documenting a traditional Chinese temple, a church, and a colonial bungalow in Johor Bahru, Johor. There were 10.5% more female respondents than male respondents.

*Table 2. Personal characteristics * group crosstabulation*

Personal Characteristics		**Total**	**Percentage (%)**
Cohort	X	19	47.5
	Y	21	52.5
Total		40	100
Gender	Female	21	52.5
	Male	19	47.5
Total		40	100

An online questionnaire invitation was posted in the university's official Learning Management System (LMS) and social media to ensure wider accessibility. Email and social media invitations containing the survey link were also delivered to the target participants. Responses were directly recorded on a database file on the website server. As illustrated in Table 3, the online questionnaire consists of four sections to assess the following variables:

- Questions 1 & 2: respondents' personal characteristics (cohort and gender);
- Questions 3(a)-3(e): respondents' ratings on place identity knowledge acquisition;
- Questions 4(a)-4(e): respondents' ratings on community's social contexts understanding;
- Questions 5(a)-5(e): respondents' ratings on community's cultural contexts recognition

Responses were measured using Likert scaling method with 5 ratings (1 - strongly disagree to 5 - strongly agree). Respondents' personal characteristics (cohort and gender) were kept constant to ensure that they do not affect their evaluation. They were used to test the correlations between the respondents' personal characteristics with their ratings. Ratings on the place identity knowledge acquisition, community's social contexts understanding, and community's cultural contexts recognition categories would indicate the extent to which the PBL instructional approach adopted in the measured drawing module significantly affects students.

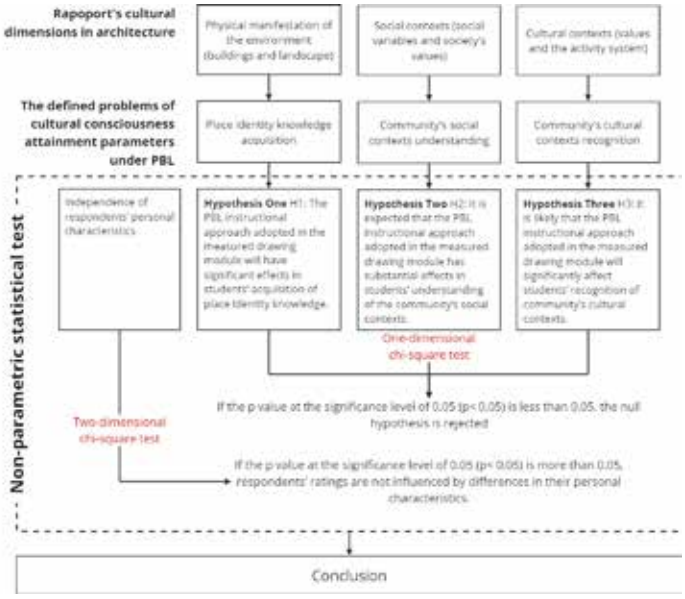
Table 3. Online questionnaire questions

Place Identity Knowledge Acquisition	Community Social Contexts Understanding	Community Cultural Contexts Recognition
3(a) I can identify the characteristics of the physical fabric of the place I have documented.	**4(a)** I am able to interpret the relationship between spatial layout of the building with the social structure of the users associated with it.	**5(a)** I can describe the cultural meanings of the ornamentation features of the building.
3(b) I can describe the distinctive building facades and architectural styles of the building I have documented.	**4(b)** I can describe the social status of the community related to the building I have documented.	**5(b)** I am able to gain understanding of the values and beliefs of the users or community related to the building.
3(c) I am able to tell about the place's history from my documentation work.	**4(c)** I am able to gain understanding of the organizational structure of the community related to the building I have documented.	**5(c)** I am able to gather knowledge of the communal activities i.e. prayers, rituals, consecration of ancestors, gathering of community members and etc.
3(d) I am able to gain knowledge about the place attributes by documenting identified traditional businesses and trades related to the community.	**4(d)** I can relate the social network of the community with the building I have documented.	**5(d)** I can identify distinctive cultural displays of the users or community associated with the building i.e. customs, art, food, clothing, language, ornamentations & etc.
3(e) I can differentiate the features of the place I documented from another place that I have been to.	**4(e)** I am conscious that community social contexts had significantly shaped the built environment of the place I have documented.	**5(e)** I can appreciate the cultural system of the community related to the building I documented.

Greene and D'Oliveira (1982) suggest that non-parametric statistical tests are appropriate for experimental data that are measured at ordinal level or nominal level. The data in this study are based on response-rating scales (ordinal data). Furthermore, non-parametric statistical tests are used when it's not possible to obtain an assumption of normal distribution (Sedgwick, 2015), particularly for the ordinal data in this study. Lucas (1991) also recommends the use of non-parametric statistical tests for small sample size. Hence, non-parametric tests are appropriate to analyse the data.

The analysis firstly examined the independence of respondents' personal characteristics using two-dimensional chi-square test using SPSS software. If the p value at the significance level of 0.05 ($p < 0.05$) is more than 0.05, respondents' ratings are not influenced by differences in their personal characteristics. To test hypotheses H1, H2 and H3, one-dimensional chi-square test was calculated. If the p value at the significance level of 0.05 ($p < 0.05$) is less than 0.05, the null hypothesis is rejected, indicating that the PBL instructional approach adopted in the measured drawing module has significant effects on students' cultural consciousness attainment. Figure 3 illustrates the research framework.

Figure 3. Research framework

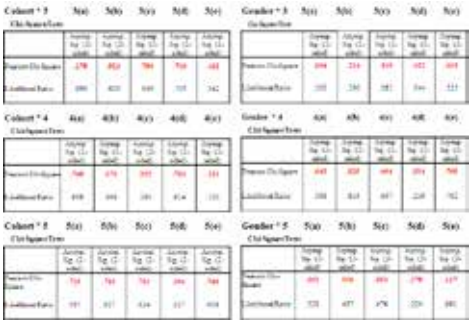


FINDINGS

Respondents' Characteristics Independence

Respondents' personal characteristics independence was examined using two-dimensional chi-square test. The results in Figure 4 show that overall p value for all tested variables were more than 0.05 ($p>0.05$), indicating that respondents' ratings were not influenced by differences in their personal characteristics. The personal characteristics factors were kept constant and did not significantly affect the evaluation.

Figure 4. Results of the two-dimensional chi-square test to test respondents' characteristics (cohort and gender) independence



Place Identity Knowledge Acquisition

The null hypothesis for Research Question 1 is:

H_0: it is predicted the PBL instructional approach of the measured drawing module will have no significant effects on students' acquisition of place identity knowledge.

Table 4. Chi-square test statistics for place identity knowledge acquisition

Question	3(a)	3(b)	3(c)	3(d)	3(e)
Chi-Square(a)	26.600[a]	7.850[b]	18.000[a]	6.650[b]	23.600[a]
df	3	2	3	2	3
Asymp. Sig.	**.000**	**.020**	**.000**	**.036**	**.000**

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 13.3.

From Table 4, p value for all questions 3(a)-3(e) in the place identity knowledge acquisition section were less than 0.05 ($p<0.05$). H_0 was rejected, indicating that the PBL instructional approach of the measured drawing module has significant effects on students' acquisition of place identity knowledge.

Community Social Contexts Understanding

The null hypothesis for Research Question 2 is:

H_0: It is predicted the PBL instructional approach of the measured drawing module will have no substantial effects on students' understanding of the community's social contexts.

Table 5. Chi-square test statistics for community's social contexts understanding

Question	4(a)	4(b)	4(c)	4(d)	4(e)
Chi-Square(a)	21.200[a]	10.400[a]	20.600[a]	44.750[b]	13.800[a]
df	3	3	3	4	3
Asymp. Sig.	**.000**	**.015**	**.000**	**.000**	**.003**

c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.
d. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.0.

From Table 5, the p-values for all questions 4(a)-4(e) in the community's social contexts understanding section were less than 0.05 ($p<0.05$). H_0 was rejected, indicating that the PBL instructional approach of the measured drawing module has significant effects on students' understanding of the community's social contexts.

Community Cultural Contexts Recognition

The null hypothesis for Research Question 3 is:

H_0: It is predicted the PBL instructional approach of the measured drawing module will not significantly affect students' recognition of the community's cultural contexts.

Table 6. Chi-square test statistics for community's cultural contexts recognition

Question	5(a)	5(b)	5(c)	5(d)	5(e)
Chi-Square(a)	54.750[a]	30.800[b]	35.600[b]	22.200[b]	21.200[b]
df	4	3	3	3	3
Asymp. Sig.	**.000**	**.000**	**.000**	**.000**	**.000**

e. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 8.0.
f. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 10.0.

From Table 6, p value for all questions 5(a)-5(e) in the community's cultural contexts recognition section were less than 0.05 ($p<0.05$). H_0 was rejected, indicating that the PBL instructional approach adopted in the measured drawing module would significantly affect students' recognition of the community's cultural contexts.

DISCUSSIONS

Cultivating Cultural Consciousness Through PBL-Designed Learning Experiences

PBL serves as a pivotal tool in identifying and framing specific issues within real-world contexts. This is particularly significant in developing an understanding of the interplay between a place's characteristics and the formation of place identity. This establishes the problem that guides students' learning in heritage architecture, by exploring how the distinctive features of a place contribute to shaping its unique identity. Students are directed by a clear framework to document, analyze and interpret the characteristics of place identity, which ultimately shapes their cognitive understanding. Without a clear framework initiated by a problem, students may not be able to develop a depth of inquiry, and such learning would remain superficial.

As active participation engages and motivates students in their learning (Bergmark & Westman, 2018; Sharoff, 2019), PBL incorporates students' active learning in developing and executing solution strategies to address the established problem. Architectural drawings provide insights into the spatial configuration, building technology, and symbolic representations that exert profound influences on culture and society in terms of architectural production. However, a good execution of data collection is essential, involving physical measurements of buildings and gathering of research materials for drawings production and historical analysis. Students need to formulate the most effective ways to collect data, as reflected in the fieldwork planning where specific tasks are allocated to each group member. A clear work schedule outlines milestones and provides a roadmap to the successful completion of tasks within the stipulated timeframe.

Another important aspect of PBL is the development of collaboration in the learning process (Ariyanto & Muslim, 2019; Hendarwati et al., 2021; Murray-Harvey et al., 2013; Saldo & Walag, 2020). The cloud service provides an excellent collaborative platform for modeling work production and facilitating progress reviews. This platform allows the instructor to view the 3D models in real-time on the cloud and provide comments with direct annotations. Furthermore, the integration of Google Documents into the workflow enables students to make real-time amendments and facilitates the simultaneous viewing of

the report by all team members. These settings not only increase overall productivity, but also contribute to a more efficient findings review and evaluation process.

Social engagement as a part of PBL process enhances students' learning experience (Arnold, 2022; Chung, 2019; Leidig & Oakes, 2021). Participating in exhibitions and seminars offers opportunities to further engage with real communities, thereby enriching students' learning experiences by connecting with real-world contexts. These interactions extend beyond traditional classroom settings and allow students to view their projects from a more holistic perspective. As they showcase their findings, students not only reflect on their individual learning experiences but also actively share the knowledge they have acquired with the public.

Figure 5. The PBL-designed learning experience in cultivating students' cultural consciousness, from the left, the physical measurement, the cloud-based model review, and an outcome sharing session with the local community

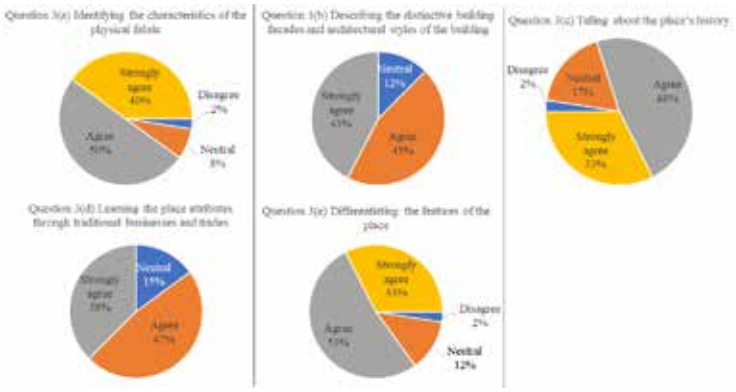
Source: Authors' (2023)

Acquiring Place Identity Knowledge

The findings from the study reveal that the PBL instructional approach adopted in the measured drawing module has positively contributed towards students learning. A large percentage of students, as indicated by the "Agree" and "Strongly agree" ratings in the survey, recognised the specific attainment of cultural consciousness elements in all three cultural dimensions of architecture.

The data presented in Figure 6 illustrate the extent to which students acquired knowledge of place identity through their learning experience. Indicators include identifying the physical fabric characteristics; describing the distinctive building façade and architectural styles; telling the place's history; understanding the place attributes through traditional business and trades; and distinguishing the features of the place.

Figure 6. Respondents' ratings for place identity knowledge inquiry

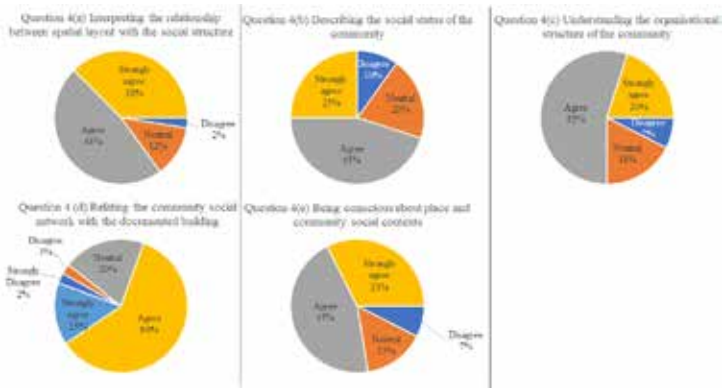


Most of the respondents agreed that they were able to acquire place identity knowledge from their learning experiences. As shown in Figure 6, 90% of them were able to identify the characteristics of the physical fabric of the place, such as the urban layout, road networks, buildings, public spaces, and so on. 87.5% of the students were able to describe the distinctive building facades and architectural styles of the heritage buildings they documented. This knowledge is further enhanced with the understanding of the place's history, as claimed by 85% of the respondents. 85% of the students agreed that they managed to learn about the place attributes through traditional businesses and trades. 85% of the students agreed that their learning experience enabled them to distinguish the place features they studied from another place that they have been to. It is evident that students were able to develop their cognitive understanding of a distinctive characteristics that form the place identity. This reflects the significance of place-specific architectural education as emphasised by Smith & Sobel (2004) and Nikezić & Marković (2015).

Understanding of Community Social Contexts

Figure 7 illustrates how students demonstrate understanding of community social contexts guided by the PBL approach in their measured drawing project. This encompassed interpreting the relationship between spatial layout and social structure, describing the social status of the community, understanding the community's organizational structure, establishing connections with the social network, and recognizing the influence of community social contexts on shaping the characteristics of a place.

Figure 7. Respondents' ratings for community social contexts understanding

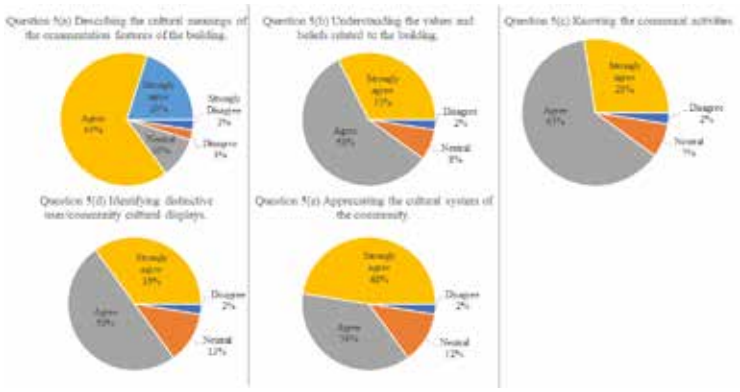


A significant number of students, at 85%, demonstrated the ability to interpret the relationship between the spatial layout of a building and the social structure of the users connected to it. This highlights their awareness of the interplay between architecture and societal dynamics. A substantial 70% of students were able to provide descriptions of the social status of the community associated with the documented heritage buildings, while 75% of the respondents managed to gain an understanding of the organizational structure within the community linked to the documented building. A further 75% of students were able to draw connections between the social network of the community and the buildings they documented. 77.5% of students recognized the pivotal role of community social contexts in significantly shaping the built environment of the place documented. These findings reflect the students' ability to develop comprehension of the broader social context related to heritage architecture and community spaces. They were also able to demonstrate analytical skills in identifying the influence of societal forces on the architectural development of a particular community. These findings highlight the significance of social-architectural knowledge and how PBL contributes to a deeper understanding of this relationship.

Recognising the Community Cultural System

Figure 8 demonstrates the students' ability to identify the cultural system within the community. This involved describing the cultural meaning of ornamentation features of the building; grasping the values and beliefs associated with the building; familiarizing themselves with communal activities; identifying distinctive cultural displays; and gaining an appreciation for the community's cultural system.

Figure 8. Respondents' ratings for community cultural contexts recognition



The questionnaire findings show that through their involvement in heritage building documentation, 85% of the respondents were able to describe the cultural meanings underlying the ornamentation features of the buildings. Furthermore, a vast majority of students, at 90%, understood the values and beliefs held by the users and communities associated with the buildings they documented. In addition, an equivalent 90% of the students effectively gathered knowledge concerning the communal activities, encompassing prayers, rituals, ancestral consecrations, community gatherings, and more. 85% of the respondents showcased their ability to identify distinctive cultural displays of the users or communities associated with the buildings. Finally, a substantial 85% of the students demonstrated appreciation towards the cultural system embedded within the communities related to the buildings they documented. These findings indicate students' profound understanding of cultural influences in shaping architecture. Through heritage architecture documentation, they learned about the aesthetic and symbolic dimensions of architectural design and the empathetic approach to cultural perspectives. The students' comprehensive insight into the cultural practices within the communities is evidently portrayed. This understanding reflects not only their cognitive learning in heritage architecture, but also their respect for cultural diversity of the various communities they encountered during their study. Recognizing the cultural activities within a community strengthens learners' knowledge of a place (Koh & Ahamad, 2023). This reinforces the role of PBL in enhancing understanding of culture and architecture.

FUTURE RESEARCH DIRECTIONS

Further investigation on how PBL affects students' cultural consciousness could take into account their personal experiences. A qualitative approach in a subsequent study could also further explore the scope of experience to identify emerging themes that highlight PBL's contribution in their learning. Additionally, investigating the long-term effects of PBL on students' ability to integrate cultural sensitivity into their design studio projects should be considered for future research.

CONCLUSION

In addition to addressing technical aspects, architectural design challenges often encompass complex dynamics related to place, community, and culture. As emphasised by the International Union of Architects, architectural education must inculcate problem-solving skills to address these multifaceted aspects (UIA, 2023, p.5). Adopting a problem-based learning framework is crucial in training students to address issues that intersect with these critical dimensions.

Jadresin Milic et al. (2022) highlight that the advancement of teaching and learning architectural history depends on heritage, conservation, community engagement, digital technology, and expertise in measuring and drawing buildings. According to Philokyprou (2011), heritage architecture education equips students with foundational knowledge and analytical skills for assessing vernacular buildings and historical settlements across various dimensions. This cultivates cultural consciousness by recognising the diversity of cultures, particularly in societies with diverse cultural characteristics. Therefore, learning from the real-world contexts through heritage architecture documentation appears to be significant.

As Akboy-İlk (2007) highlights, measured drawing allows the establishment of deep relationship between the inquirer with the architectural fabric throughout the process of documentation, analysis, observation, measuring and interpretation. Such an enquiry process, supported by a clearly defined PBL framework, enables students to elucidate the meanings of architecture within a specific place and community.

Findings from the research substantiates the adoption of PBL as an effective pedagogy to improve students' cultural consciousness attainment. Positive evaluation outcomes of this research serve as an important indicator of students' ability to develop contextual and cultural sensitivity. With the acquired learning experiences involving place identity knowledge, community social contexts, and their corresponding cultural system, students become able to develop their design cognition consciousness towards place contexts which is critical in preserving its cultural sustainability. The PBL framework is also useful in guiding the design of teaching approaches for cultural related subjects in other disciplines.

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KEY TERMS AND DEFINITIONS

Cultural Consciousness: Understanding and recognition of diverse cultures, resulting in a deeper knowledge and appreciation of other individuals and contexts.

Cultural Context: Values and activity systems of the community.

Measured Drawing: A standardised method of documenting the existing architectural conditions of a building.

Place Identity: The perceived meanings derived from the spatial setting that determine the values associated with the human relationship with the place.

Problem-Based Learning: An instructional method that utilizes problems to help students develop problem-solving abilities and acquire fundamental knowledge.

Social Context: The settings depicted by social variables and society values of a particular place.