

# Metacognitive Strategies to Foster Interculturally-Aware Design Competency

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## ABSTRACT

Metacognition is vital for learning in general, and its value for HCI educational practices warrants investigation. In general, metacognitive awareness can help student designers consider how their thought processes might influence their design outputs. More specifically, it may also have relevance for helping HCI students develop intercultural competence—particularly when students interrogate their own cultural biases and can reflect on the cultural implications of their work. However, there are several challenges associated with developing metacognitive skill in instructional settings, and these may be exacerbated in intercultural settings. In this paper, we share an account of how we engaged with students participating in a study abroad experience, using daily reflection sessions to encourage students to develop their metacognitive awareness and intercultural competence while they worked on digital civics projects in an unfamiliar cultural setting. We describe the metacognitive strategies that we identified within our students' reflections. Through our narrative, we are able to highlight the intersecting roles that digital civics design prompts, new cultural contexts, and metacognitive questioning may play in how students develop and express their intercultural learning.

## CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Empirical studies in HCI**; • **Social and professional topics** → **Computing education**.

## KEYWORDS

HCI education, intercultural learning, metacognition, digital civics

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## 1 INTRODUCTION

In a rapidly evolving global landscape where tools are designed and deployed across diverse cultures and contexts, there is a growing interest in providing HCI students with intercultural skills to empower them to thrive and provide value to a global and multicultural user audience while also delivering beneficial outcomes to their future employers. There are some existing efforts within the HCI community to introduce intercultural-focused pedagogical activities within the HCI curriculum [1, 4], but relatively little is still known about how these approaches might provide embodied intercultural experiences that expose and immerse the students in intercultural contexts and problem spaces. One such type of pedagogical approach commonly used in general higher education settings is study abroad programs. This type of global experience is typically designed to enable students to gain intercultural competency by immersing them in a different culture with a mobility component (i.e., traveling to the host country), allowing them to learn and address problems in their new environment and context while building integrated intercultural knowledge in the process.

Building on learning sciences and intercultural pedagogy literature, we realized the need to structure and support students' metacognitive abilities in these international experiences. Metacognitive ability has long been connected to reflection and design cognition [2, 8], and these metacognitive skills are also highly relevant to intercultural competency since they allow access to mindfulness, monitoring, and selection of appropriate social interaction strategies [13]. Pairing the development of metacognitive

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skills with intercultural instruction provides design students with a unique opportunity to gain awareness of their cultural positioning alongside challenges they may already be facing in their design learning, and limited prior work suggests this area as potentially fruitful for further research and pedagogical guidance. Lane [10] found that employing metacognition as an instructional framework in immersive cultural learning environments allowed students to progress through different stages of intercultural development toward attaining intercultural competence. They highlighted that applying metacognitive techniques in an intercultural context gave students active control over their intercultural learning experience, allowing them to refine and improve on areas that need attention. In a general purpose technology education framing, Takahashi and Murata [14] similarly highlighted that providing students with techniques to develop and improve their metacognitive awareness allowed them to build necessary competencies, further highlighting that scaffolds (e.g., strategies, tools, resources) can support the development of metacognitive skills. Knox et al. [9] argued that the levels of a student's overall metacognitive skill can be used to judge the potential performance of students in a given task that is relatively new to them. Hysaj and Hamam [7] suggested that formative feedback following a metacognition session is valuable in aiding student development, and that students can recognize the importance of such feedback for their skill development. Altogether, this background of scholarship highlights the potential benefit of employing metacognition techniques in fostering the intercultural learning of students. Although various authors have promoted the benefits of metacognition in developing and supporting intercultural awareness, several limitations remain, including inability to measure effectiveness of the approach, difference between students in their willingness to share their thoughts, and difficulty assessing student performance during the metacognition process, among other challenges.

To further understand how metacognitive approaches might augment intercultural HCI learning environments, we build upon some rare examples of intercultural HCI educational scholarship that suggests areas of weakness that might warrant further pedagogical support. Gray et al. [5] noted that pairing a study abroad experience with a digital civics focus (see [12, 15] for a fuller description of this approach to HCI research and design activity) allowed students to work on projects they find interesting, while also supporting them in developing intercultural competence. However, they found that the dual challenge of framing a new problem space in a short amount of time and also seeking to understand the unique ecological factors impacting people in this new (for them) intercultural context often felt overwhelming. Abdelnour-Nocera et al. [1] described intercultural implications for the teaching of HCI in different contexts, revealing challenges in building intercultural awareness in relation to core HCI curricula. They found that epistemological differences led to a lack of alignment across pedagogical strategies and the ability of students to know how to act. Li et al. [11] further engaged with an intercultural team of HCI educators and students to learn about their experience designing and participating in educational experiences in the United States and China, revealing challenges in building reflexive and culturally-appropriate pedagogical strategies in learning experiences while

also challenging students to appreciate multiple types of pedagogical strategies to inform their development of design ability. In this case study, they found that some pedagogical norms and challenges translated well (e.g., project-based curricula) but different cultural contexts had a dramatic impact on barriers that students had to overcome—for instance, in getting critical feedback on work and challenging social norms.

In this paper, we build upon our team's collective experience of supporting and structuring student engagement in a study abroad program to the United Kingdom across five years with over 70 undergraduate and graduate students. The paper authors include program faculty who co-led multiple iterations of the program (Colin, Paul, and Austin) and graduate students who participated in one instance of the program (Ike, Suchi, Moon, and Prateek). Our focus in this paper is on a series of eight reflection sessions that we ran with students over multiple years. Through our analysis and reflexive engagement in design activities with different cohorts of students, we generated a set of five challenges and potential strategies for metacognitive engagement in intercultural knowledge that may be useful for HCI educators to use when building students' intercultural design competence. We approach this topic as both an *unsolved challenge*, since there is much work left to be done to refine and contextualize these strategies, and as a *teachable moment* that has the potential to benefit other HCI educators, since we have learned from our own experiences running these reflection and metacognition activities as instructors and graduate student facilitators.

## 2 METHOD

In this paper, we share the experiences of three course instructors that have supported intercultural learning of students on one or more of the study abroad trips to identify a set of potential pedagogical strategies. These strategies were outcomes of reflection sessions conducted with students and analysis of other learning artifacts, and may serve as a useful point of departure for HCI educators seeking to support students' metacognitive engagement with design and intercultural competence.

### 2.1 Data Collection

Data for this study were generated from group reflection sessions and written reflections created by students participating in a 16-day study abroad program to the United Kingdom. This program has been conducted on four separate years with a total enrollment of approximately 70 students, including primarily undergraduate UX Design students and a smaller portion of masters and doctoral students. While our analytic focus is on the 2022 version of this program and the 22 students enrolled for that year, we built upon similar data sources collected from 2018 and 2019 iterations of the program as well.

All student participants were enrolled in an undergraduate or graduate degree program in UX Design at a large Midwestern US university. However, all of the graduate participants and a portion of the undergraduate participants across multiple years of the program had a country of origin different from the US or UK, including participants from India, Nigeria, South Korea, and China. In the

2022 version of the program, 16 of the participants were undergraduate students, 4 were masters students, and 2 were PhD students. Two students in this program cohort had visited or lived in the UK at different times in their life, but the vast majority were visiting the country for the first time. While some might argue that students traveling from the US to the UK will not be experiencing much of a culture difference due to the shared language, intercultural competence scholars have previously hypothesized that such a transition might cause students to “deny” any cultural differences whatsoever or “minimize” these differences (both symptoms of ethnocentric views of intercultural competence) [6]. The students were assigned to a digital civics-focused HCI project that had been structured by our hosts in the United Kingdom, and each student team had approximately six working days to understand the problem context, conduct design or research activities, and present their findings to their project sponsors. Our analysis for this project focuses on the reflection of the students working on these projects and also their general experience with the local culture in the part of England we were visiting. Quotes throughout this manuscript use pseudonyms to protect the privacy and confidentiality of the students.

Eight 30-minute, semi-structured reflection sessions were held on different days during the study abroad program. The first four sessions commenced with an instructor sharing targeted prompts with the students, encouraging them to consider:

- What were some of the unique things that you observed in your new surroundings?
- How did your observation differ from what you are accustomed to? (i.e., a comparison of the observed phenomenon with its occurrence in their home culture)
- Do you think the thing you observed is a representation of the new culture, or a probable, circumstantial occurrence specific to a smaller group?

The subject of observations, referred to as “things,” was open to interpretation for the students, whose responses tended towards day-to-day objects, social cues, aspects of their projects, reflections on their project sponsors, and behavioral patterns in social interactions. These sessions were designed to nudge students to observe their surroundings as part of a cultural exchange and to discuss these observations with their peers. Sessions were recorded with student consent as part of a project approved by our institutional review board. For the four reflection sessions that took place during the second half of the program, the instructors introduced the concept of metacognitive strategies and added additional prompts to allow students to consider *why* they observed what they observed, *what factors* led them to form the impressions they formed, and *how* they reached the conclusions they reached. These prompts were framed to expose the students to the awareness that they could intentionally engage with their own thought process as a means of enhancing their outcomes in this new environment. The last out of the four reflection sessions was led by the graduate students participating in the program (some of whom who are co-authors on this paper), who were able to draw on their own experiences as co-participants of the program and their analysis of reflections from 2018 and 2019 (described below) in asking pointed questions about the challenges the students faced with the embodied complexities of designing for and with a cultural context with which they were

unfamiliar. This approach further encouraged the students to reflect on the methods and design activities they performed through their projects and with their project sponsors.

## 2.2 Data Analysis

The course instructors provided the graduate students with transcriptions of a subset of morning reflection discussions from two previous study abroad programs (2018, 2019) on day four of the graduate students’ study abroad experience. The instructors asked the graduate students to leverage their own experience of study abroad thus far and use their qualitative coding skills gained in their graduate program to conduct open coding on assigned portions of these previous datasets. Through discussion, we decided to focus our analysis on the metacognitive strategies the students employed to navigate their new environment, since this kind of deliberative language would be most likely to be found in the reflections we were using as our primary data collection method. Six graduate student researchers participated in this open coding process, supervised by one of the three instructors for this project.

Through this open coding analysis, as a group we constructed five primary metacognitive strategies as themes that were employed by past and current study abroad students, including: noticing, simmering/fermenting, acknowledging complexity and insufficiency of knowledge, questioning assumptions, and critically engaging. Next, we converged as a team of instructors and students to discuss the preliminary findings and to construct appropriate definitions for each strategy using sample representative quotes. We then employed these strategies as a guide for additional analysis of the entire dataset that was generated from the group reflection sessions and individual final written reflection that were part of the 2022 study abroad program. All six graduate students participated in this second round of thematic analysis, working in pairs. Each student analyzed the dataset reflexively according to their interpretation and positionality. Furthermore, conducting this analysis enabled us to foreground and analyze the metacognitive strategies employed by the student participants as they acclimatized to their new environment during the study abroad program. In all, we analyzed the eight group reflections that included all 22 participating students, and through this analysis foregrounded the different metacognitive strategies the students exhibited as they were acclimatizing to the new context and culture, in addition to the problem space situated in this new context.

## 2.3 Research Reflexivity and Positionality

In line with the principles of reflexive thematic analysis as proposed by Braun et al. [3], we considered researcher subjectivity and multiple perspectives as an asset that enables our research team members to interpret their experiences and perceptions through their own cultural membership and positioning. The researchers that participated in this project are from diverse nationalities and cultural backgrounds, including India, Nigeria, USA, South Korea, and China. Through the process of constructing thematic strategies and reflecting upon our own experiences as authors and researchers, many of our own metacognitive strategies became more accessible to us in ways that are rooted in our own lived experience. For instance, some of the graduate students had previously adapted

to other cultural contexts, and were able to leverage that knowledge to identify what other students were now facing. Additionally, since the study abroad leaders were from the US and Canada, the explanation of other forms of cultural adaptation by the graduate participants allowed us to engage in deeper discussion about the role, purpose, and shortcomings of these metacognitive strategies. Thus, our diverse cultural perspectives in combination with our varied educational backgrounds allowed us to provide a richer interpretation of the metacognitive strategies participants in the study abroad program employed to adapt to their new environment while working on digital civics projects.

### 3 FINDINGS

In this section we present the metacognitive strategies we identified in the students' reflections during the study abroad program. We focus our attention on how the strategies foreground the different ways in which the students engaged in metacognition to adapt and thrive in their new environment and as a means of gaining inter-cultural competency for designing for users in their new environment. Furthermore, these strategies are not mutually exclusive but instead were often found in combination as students employed them as a support for sense-making in their new environment.

#### 3.1 Noticing

The noticing strategy involved the students observing the new and different elements in their new surroundings, and their interactions with and within it, with particular attention and conscious thought towards understanding what is being observed, either in the moment or in retrospect. An example of *noticing* in action is James' means of critiquing his own cultural bias, mentioning that "*when I see something different, my first impulse system, like the thought in my head, is like, 'Oh, that's weird.' But then I realized, like, 'no, maybe I'm the weird one.'*" Employing this approach allowed James to confront the bias in his thought process around his observations and subsequently his decisions. Another student, Jessica, also mentioned that she had to stop herself from noticing and comparing and instead opened herself up to learn, mentioning that "*I feel like I'm at the point where I totally curbed all of my expectations. Because I just keep getting it wrong . . . every time I expect something I'm always wrong. So I've just kind of stopped.*" Here Jessica is transitioning from noticing as a form of judgment towards noticing as a means of learning. This shift supported acclimatization to the new environment, illustrating how these sessions were designed to nudge students to observe their surroundings as part of a cultural exchange in an open posture towards their new environment. Further, noticing led to the possibility to discuss these new observations and realizations with their peers.

#### 3.2 Simmering and Fermenting

Simmering and Fermenting is the process of further deliberating and reflecting on one's original perceptions through the stimulation of the external environment, a process that gives ample room for free thinking and facilitates the constant process of acquiring new perceptions. We saw that simmering/fermenting was used most frequently as students considered how to approach working on their projects. Joseph, for instance, realized that he had very short

time for his project, making it challenging to develop a meaningful design. When reflecting about how to solve this challenge, he mentioned that "*there were plenty of times where I felt that there was no way that a simple design created in a week could impact the lives of real people in a meaningful way, but I realized that wasn't necessarily my role. I was also more aware of the fact that we were only working for such a limited time and creating something that will change a whole culture is just not possible in that timeframe.*" In this quote we see how allowing this concern to *simmer* led him to recognize the limitations he was faced with. Eric employed a similar strategy, mentioning that "*I think the key part of our perspective that allowed us to move past this challenge was the notion that we weren't trying to solve this complex issue or act like we were, but to rather focus on potential opportunities and link it with the human experience.*" In all, the simmering/fermenting strategy depicts how the students were thinking constructively about ways of developing design solutions in their new context while also acknowledging their limited knowledge, resources, and time.

#### 3.3 Acknowledging Complexity and Uncertainty

Acknowledging complexity and uncertainty involves the students accepting that there are parts of their new environment—different from their original culture—that they might be unable to change and will need to adapt to or understand differently in order to thrive. We saw this metacognitive strategy in play while the students were working on their projects. Frank, for instance, showed evidence of this technique when reflecting on his project: "*My project was focused on the impact of African lives in Northern England and I was really struggling to see any signs of it as it was so hidden. In the US, I feel like we are culturally more aware than England of the things that are taken from black culture and the impacts of their accomplishments on our current day society. I feel like my brain kept trying to compare it to what I know is stolen in the US and how it wasn't obvious at all how those things were displayed in England.*" Alexis also displayed this strategy of acknowledging complexities while engaging with their project mentioning that "*one of the most challenging parts of engaging in digital civics was that I'm not super well versed about digital civics, and I'm also not super familiar with British culture. These two things posed large informational gaps that required me and my teammates to do a lot of extra secondary research to really understand the cultural context of the problem and how different designs could fit into this framework.*" Altogether, findings from our analysis revealed that the students displayed instances of acknowledging complexity and uncertainty as a means of being mindful of the shortcomings of their knowledge to allow them to make their engagement with their digital civics projects and new environment more tractable.

#### 3.4 Questioning Assumptions

Strategies relating to questioning assumptions included instances when students described interrogating their prior knowledge in order to probe whether the specific situation required a slight adjustment to fit into the new context or demanded complete dissolution and reconstruction. For instance, some of the students questioned their assumptions as a means of examining prior expectations, with

Sydney mentioning that “[*study abroad*] actually made me realize that the UK isn’t too, too different from the US. I am not sure if this is just because we both speak English or it was really similar I just found a lot of similarities. I found it interesting how everyone was like ‘OMG you’re from the US’ rather than thinking we were dumb Americans, I wasn’t really expecting that.” Another student described their experience of using a common design tactic of externalizing their thought process in order to get feedback from their peers as a strategy to confront their assumptions: “*there’s this like, thing in my head. And the way that I break myself away from that is I just—I’m just like, ‘I’m gonna see what other people think.’ I know that there’s this thing in my head that, like, I have and that’s only me—that’s my very particular brain thinking in a very particular way. And I know that not everyone’s going to think that way. But it’s hard to break yourself off of that idea that, like, you have this idea in your head of how it’s going to go or what it’s going to be and then you have to—you have to break it every time.*” Altogether, the questioning assumptions strategy showed that the students were interrogating what they are actively experiencing in contrast with their preconceived expectations about potential outcomes and reacting appropriately based on the those outcomes.

### 3.5 Critically Engaging

We categorized strategies as critically engaging when the students described making judgments about their environment and the context they encountered as a means to further acknowledge the cultural biases their own judgments were based on. We also categorized discourses as critically engaging when the students displayed instances of providing alternative explanations they are experiencing. One of the students, Mihyun, while reflecting on their visits to one of the British monuments commented: “*the Durham Cathedral tour made me feel like mixed feelings about all the like, ‘oh, a lot of invaders come in and then took down.’ But in our case a lot of international students are like ‘well, you guys did that to us.’ Yeah, I get it.*” Similarly, another student, Michelle, employed the critically engaging strategy as a means of recognizing how a given narrative can be interpreted differently: “*so for one of our projects, the African narratives in England, we visited the Natural History Museum yesterday. And we were just kind of noticing that, like some of the plaques provided information on them saying that, ‘we don’t know how the plaques came to Newcastle, that it could have maybe come from Paris.’ I was like ‘well, you probably know how you got it, but you are just going to pretend.’”* Altogether the students displayed instances of critically engaging where they focused their attention to constructively interpret their experiences to provide a normative or moral context.

## 4 DISCUSSION AND FUTURE WORK

Our findings suggest that HCI students are able to develop metacognitive skills, with little explicit scaffolding, when immersed in an unfamiliar culture and engaged in design projects in relation to the cultural context. However, the development of metacognitive skill often benefits from some type of epistemic conflict to encourage the reflection that is required. In our case, the cultural contrast provided that conflict, and the design projects provided the authenticity and meaning required for the students to more deeply and specifically

engage with matters of cultural difference. The instructors simply encouraged the students to share their experiences in response to reflection prompts that increasingly incorporated metacognitive elements as the program progressed (e.g., asking students to think about **why** they were noticing specific kinds of things, in addition to asking **what** they were noticing). While portions of the strategies could apply to intercultural experiences and competence in general, the ways these strategies were operationalized by students was quite specific to the challenges of HCI project work. All of the strategies were used to guide students’ selection of appropriate research or design activities, or to negotiate how they could address complex problem frames within the short time period allowed. Thus, while some of the use of these strategies and shared in student reflections was positioned through the capacity of one’s “human-ness” rather than as a designer, the abilities related to these strategies mobilized the designer’s character and moral perspective in ways that ultimately shaped their work as HCI designers.

Although this work is presented as an “unsolved challenge,” as we have only identified some possible strategies, we believe that HCI educators can employ similar strategies to engage students in this kind of metacognitive and intercultural development. Analysis of student reflections shows their ability to develop metacognitive awareness and control in a reflective and reflexive way, particularly in relation to several strategies that we have identified above. Our findings reveal that the students were able to reflect on their own cultural positioning as they adjusted to designing for a cultural context with which they were unfamiliar. Because engaging with the cultural context of a problem or opportunity space is a crucial element of many HCI design processes—especially in relation to digital civics—it is important to interrogate methods by which students meaningfully engage with cultural concerns.

This work creates a pathway for additional research on supporting intercultural development in HCI education, including potential use of these strategies in HCI education contexts that do not center on study abroad or other forms of mobility-based learning experiences. We have begun to include some of these strategies in our regular residential HCI courses as well, adapting them to encourage students to consider *why* they notice what they notice when engaging in project work or research-specific activities. In our educational practice thus far, we have identified that incorporating these strategies as a lightweight set of heuristics to guide classroom reflection can help students identify how their own assumptions about social context (e.g., urban vs. rural), socio-economic status, and technology familiarity—including how these factors influence what they design for class. Likewise, prompting students to dig deeper into the existence of multiple potential interpretations about why the population they are designing for engages in the way they do with a particular product appears to help redirect students who quickly assume that they fully understand a problem space. We believe further research on these strategies will provide useful insights for other HCI and design educators, inspiring pedagogical practices and new instructional supports relating to intercultural development and awareness in HCI education.

## 5 CONCLUSION

In this paper, we examined the metacognitive skills displayed by design students as they adapted to their new study abroad environment and digital civic projects. Through a thematic analysis of the reflections of the students, we developed a set of strategies that characterized the ways in which the students reflected on their own thought processes towards adapting their digital civics design decisions to the emerging contexts in their new environment. These strategies included acknowledging complexity and uncertainty, questioning their own assumptions, critically engaging, noticing new experiences, and simmering/fermenting. Findings from this paper provide potential tools for HCI educators to incorporate into classroom instruction, whether in a traditional instructional environment or mobility-based program.

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