A Cross-Cultural Evaluation of HCI Student Performance – Reflections for the Curriculum

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Abstract. Human-computer interaction has become a subject taught across universities around the world, outside of the cultures where it originated. However, the implications of its assimilation into the syllabus of courses offered by universities around the world remain under-researched. Our research project provides insights on these implications by studying the performance of HCI students in universities in UK, India, Namibia, Mexico and China engaged in a similar design and evaluation set of tasks. It is argued that the predominant cognitive styles and cultural attitudes of students located in different types of institutions and countries will shape their learning of HCI concepts and tools. This paper in particular reports the analysis of cognitive styles and cultural dimensions of students engaged in a heuristic evaluation of a science education portal. An emergent pattern between adaptive cognitive styles and high uncertainty avoidance is identified in the assessment of the richness of students' heuristics exercise completion.

Keywords: HCI education, culture, cognitive style, design, evaluation.

1 Introduction

Human-Computer Interaction (HCI) is a well-established and important subject in computing, technology and design in universities across the world. HCI is taught in order to explore, understand and aid in improving the usability and user experience of interactive systems and products. Though similar methodologies and frameworks are taught in this subject, little is known of the student experience and how local perspectives could influence their content and approach to teaching. Therefore, a current challenge for this discipline is making visible the possible tensions created between local cultures and predominant cognitive styles and the assumptions, priorities and values embedded in HCI concepts and methods mainly developed under particular paradigms.

In pursuing the above challenge, we studied how undergraduate students of HCI engaged and performed in similar design and evaluation tasks in institutions in China, Namibia, India, Mexico and the United Kingdom. By doing this, we hope to provide insights on the nature of HCI education as an intercultural encounter and the

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opportunities this can bring to locally validate, question and enrich some its curriculum and associated delivery. Including these insights into an international HCI curriculum will make it more sensitive to different types of students, which in turn will be better prepared to engage in tasks requiring different types of skills. This paper describes this study and initial findings about cognitive styles and cultural attitudes for HCI students located in the aforementioned countries.

The paper first defines our key working concepts for culture and cognitive styles. This is followed for a brief overview of research in HCI education and culture. The methodological strategy and the nature of workshops done with students are then presented. We then go on to report initial findings in terms of cognitive styles, culture and student performance in a heuristic evaluation task. The paper closes by highlighting main contributions and take-aways for developing a stronger HCI curriculum more sensitive to different types of students.

2 Culture and Cognition

Western HCI tools and techniques might not be effective in developing countries and that some degree of localization or adaptation are required [1]. An objective of this project is to look into this in a HCI education context, and to make sense of variations, convergences and emergences from a student centred perspective. In this section we introduce the main cultural theories underpinning this objective.

Researchers in the fields of both culture and cognitive styles have identified a correlation between cultural characteristics and the holistic or intuitive versus analytical dimensions of cognitive style [2,3].

Nisbett & Norenzayan [2] explored the relationship between culture and cognition by looking at cultural differences between East Asians and people from the Western world. They discussed how an inclination towards holistic or analytic reasoning is influenced by cultural identities. Nisbett differentiates between holistic and analytic reasoning, defining holistic thought as 'an orientation to the context or field as a whole' and analytic thought as 'detachment of the object from its context' [2, p.19].

Hayes and Allinson [3] tested the hypothesis that culture would account for differences in learning style in a study involving managers from East Africa, India and the United Kingdom. Using Hofstede's [4] four national culture dimensions and Honey and Mumford's Learning Style models, Hayes and Allinson identified two dimensions of learning style, Analysis and Action [2]. Further work in this area resulted in Allinson and Hayes' Cognitive Style Index (CSI) designed to test whether individuals tends more towards an intuitivist (right brain dominant) or analyst (left brain dominant) approach.

3 HCI Education in Different Countries

Though there are numerous articles on HCI education and a few in relation to a country's delivery of the subject, there is no substantial body of literature which offers a thorough investigation into the influence that culture and cognitive styles have on

learning HCI concepts and tools in comparison with other countries/cultures. There are however a number of studies that discuss HCI education delivery in certain countries such as New Zealand [5], Sweden [6], South Africa [7], Brazil [8] and Costa Rica [9].

These studies offer a brief view into HCI education. Sharkey & Paynter [5] investigated the need and coverage of HCI in relation to their educational courses in New Zealand. Their research came to the conclusion that the use of design tools was the most common topic followed by task analysis. This contrast with Sweden [6] where design principles, processes and cognitive psychology are the two subjects deemed to be the most important. Both countries had different approaches in their decisions but it would be interesting to investigate this factor especially regarding the time elapsed since these papers were published. Also, students in Costa Rica [9] offered their view that HCI should include more graphical design and heuristic evaluations, which the institution amended to accommodate. In Brazil, de Souza [8] confirms semiotics has had a stronger influence, unlike traditions in Europe and North America, and that along with social inclusion are the two key areas that define Brazilian attitudes towards HCI.

This literature shows that despite the fact that largely the same concepts and tools in HCI are included in the curriculum of universities around the world, their delivery, in terms of what aspects are emphasized and most valued by teachers, tend to change. This existing body of research plus already available teaching materials in universities can be used as starting point to study how the teaching of HCI differs as a consequence of local academic and professional cultures. However, it is much harder to visualize cultural and learning preferences in the case of students because their work is usually more private and inaccessible. Our research contributes toward addressing that visibility gap.

4 Methodological Strategy

The case study in each country included a visit to a university where a group of around 15 - 20 undergraduate HCI students were asked to engage in a workshop, which included evaluation and design tasks for a science education portal. The activity given to students acted as a 'cultural probe' [10] as it contains elements with different cultural affordances, e.g. heuristic evaluation as stimulating analytic thinking and prototype sketching as stimulating holistic thinking. The performance of students in the workshop is analyzed and correlated with the findings for cultural dimensions and cognitive style profiles. In this paper, we only discuss the overall student performance for the heuristic analysis part of the assigned task. We quantified the richness of observations in each student's heuristic assessment using the scale of Table 1.

Quantitative data on culture for each student group was collected using Hofstede's VSM instrument [4], and Hayes and Allinson's CSI survey [3] was used to situate each student in an intuitive-holistic scale. We acknowledge the limitations of Hofstede's model on national culture [10] and are very careful not to make stereotypical interpretations or generalizations from the data collected. We were not expecting students to match the national culture scores 'predictions' for their country.

Table 1. Scale used to code the level of richness for each heuristic assessment done by students

3= clear example reference to a concrete aspect of the design of planetseed.com
2= reference to the website but only a general comment, description is provided. It is not possible to identify reference to a concrete aspect of the site.
1= general comment about the heuristic without clearly referring to website
0= no meaningful comment or no comment provided but a Yes, NO or NA was recorded for each question about the design.

The fact that they are in different countries makes them more likely to be contrasting. However, we found it useful to find out the mean scores for each group on each cultural dimension, e.g. power distance, masculinity and collectivism, to enrich our comparative analysis of quantitative and qualitative data. Qualitative data will be analyzed for manifestations of national culture dimensions [4] and cognitive styles [2]. While these different cultural models give us a top-down framework for analysis, a bottom up analysis of this data will also be developed. In this case the aim will be to uncover cultural patterns, themes and dimensions exclusively emerging from the HCI education domain. A full qualitative analysis for cultural differences is still being developed and is not included in this paper.

4.1 Workshops

Workshops were conducted at the Polytechnic of Namibia (PN), the Instituto Tecnológico Autónomo de México (ITAM), the Indian Institute of Technology Guwahati (IITG) and the Dalian Maritime University in China (DMU) and University of West London (UWL). All 5 institutions are well known within their country. Within these institutions, HCI was a core subject in PN and UWL, an option in ITAM, embedded within the whole curriculum in IITG and a core subject in the last semesters in DMU's Computer Science course. The visit also included meetings and interviews with lecturers and staff in charge of curriculum design.

The workshop involved the student in evaluating a learning node in the SEED science portal (www.planetseed.com). The target audience of this portal is school-children aged between 10 and 18, and the HCI students were required to evaluate the node in this context. The SEED portal supports a number of different language options, allowing students who do not have English as their first language to use their preferred language option and concentrate on the task in question.

These activities included a heuristic evaluation of a learning task in the portal to determine whether the design satisfied certain predefined characteristics, which requires an analytical approach. In addition, the students were asked to analyze and comment on the case study scenario. The next tasks required a more holistic and intuitive approach: the students were required to develop the persona of both a student and her teacher, and to redesign the portal in view of their findings from the heuristic evaluation. The final tasks related to analyzing their redesign in relation to standard

HCI theory and concepts. As indicated above, in this paper we are only focusing on the analysis of the heuristics task.

5 Findings

In this section we report some of our findings in relation to the cognitive styles and culture surveys with the student groups in these five countries. We also report on their performance on one of the tasks given at the workshop, namely the richness of their heuristic evaluations on the science education portal.

5.1 Cognitive Styles of HCI students

HCI practitioners act as an interface between the developer and the users during the development of computer application or website. In terms of cognitive styles this means they need analytical skills to understand the functionality of the website or application, but at the same time, they need to be able to see the 'whole picture' and put themselves in the shoes of the user. Some HCI evaluation techniques such as heuristic evaluations require an analytical approach. Others, such as the production of a persona need a more intuitive approach. In addition, whilst the developer may be more concerned with the functionality of the application, the HCI practitioner also needs to balance the need for the interface to be user friendly, and the layout, appearance and aesthetics of the interface will contribute to this. Given this, we would expect the most typical styles to be found in successful HCI students to be more balanced, ranging from quasi intuitive and intuitive to quasi analytic.

With the above expectation, the CSI was administered to a total of 109 HCI students in Namibia (n=21), Mexico (n=25), India (n=23), China (n=20) and UK (n=20). Of these, 9 surveys had missing responses and were disregarded. Of these remaining 100 students, 79% were found to fall in the category of Quasi Intuitive (n=28), Adaptive (n=25) and Quasi Analyst (n=26). The remaining 21% were split between Intuitive (n=6) and Analyst (n=15). However, what is particularly interesting is the difference between the 5 cohorts. Namibia, Mexico, China and the UK have 78%, 73%, 70% and 79% respectively falling in the categories of quasi-intuitive, adaptive and quasi analyst; however, in the case of the Indian students, 95% fell into this range.

One possible reason for the difference in profile could be due to the unique nature of the programme at the IITG in India. The IITG has both a Department of Computer Science and Engineering and a Department of Design, and the students who took part in these workshops were Design students. Cohorts from Namibia and Mexico originate in engineering faculties. This correlates with the fact that their student packs were the most detailed of the different country groups. For the UK students, this is a core module for most of the computing degree courses, with the students ranging from those with a business specialism to those on more programming focused programs, which may explain the more even spread of the profile.

Cloninger [11] differentiates between usability (the masculine, the left side of the brain, rational, and logical action) and design (the feminine, the right side of the brain, emotional, and intuitive action), and with these particular cohorts we would expect to see both dimensions represented, which goes some way to explaining the unusual CSI

profile where 95% of Indian students demonstrate styles around 'adaptive' middle point. After all, they are scientists with an aptitude for design.

5.2 Cultural Dimensions Found in Student Groups in Each University

The VSM data gave us interesting findings in terms of cultural dimensions for the student groups we studied. We do not claim in any way the scores are a reflection on national culture, but mainly use the scores obtained as top-level indicators of students' attitudinal trends in particular dimensions such as power distance and collectivism. The groups of students who completed the survey were nationals of the same country, except in Namibia where we had two Angolans and one South African, and the UK, where 10 different nationalities or cultural backgrounds were represented, reflecting the cosmopolitan character of the university.

For the cohort in the Polytechnic of Namibia (N=21), the mean scores for the VSM94 survey indicate the group is individualistic with very low power distance. This is in contrast with Hofstede's scores for most of sub-Saharan Africa indicating collectivistic societies with a tendency to a high power distance. They seem to be consistent with South Africa's scores but the latter represent respondents with British or Dutch background, whereas the Namibian cohort is fundamentally African. This might be a reflection of the culture of Namibian universities founded and developed by Europeans.

For students in ITAM (Mexico) (N=24), IITG (India) (N=27), DMU (China) (N=31), and UWL (UK) (N=21) VSM 08 was used. The decision to move to a more recent instrument was based on the fact that it offered more flexibility in establishing baseline scores for comparison of the groups. This means, however, we cannot make a direct score comparison with the students in Namibia. Figure 1 presents the results for these countries and there are some contrasts worth noting.

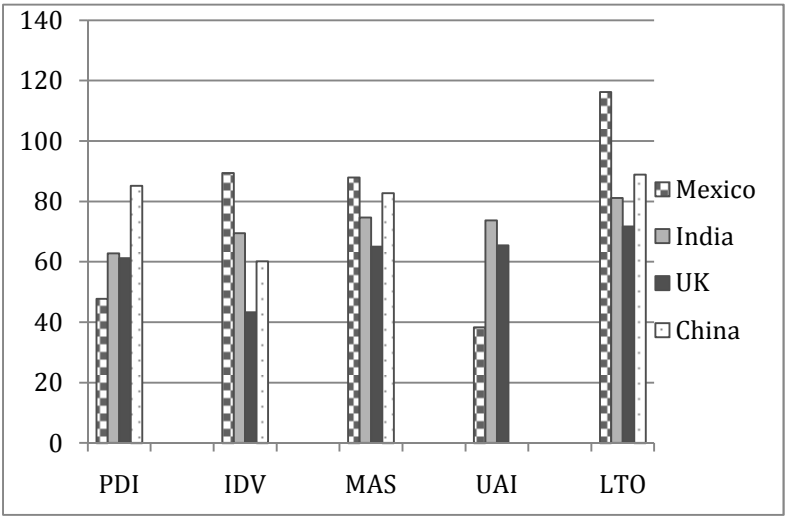

Fig. 1. VSM98 cultural dimension scores for student groups from Mexico, India, UK and China

The Power Distance (PDI) dimension was evident particularly in the relationship between the students and their professor or ourselves as researchers. The behavior of students in China, India and Mexico during the workshops reflects the difference indicated by the survey: Chinese students were the most complying ones in relation to instructions given by us and followed instructions without any question (PDI=85), Indian (PDI=62) students were more respectful and distant while Mexican (PDI=47) students were slightly more relaxed. This has a direct effect on the reflective learning process required in concepts and methods in HCI where the student is required to approach users and stakeholders with different levels of authority.

Original Hofstede's scores for Mexico and India indicate that the former is less individualistic than the latter. In our survey we have found the opposite (IDV: Mexico=89; India=69). This can be a reflection of the university culture in ITAM, where a lot of emphasis on individual success is evident in terms of financial awards in the form of fee waivers for the best performing students. While attempting the tasks, Mexican students displayed more independence and less interaction between peers than in India. Chinese students were clearly the most collectivist ones in terms of their group behavior during the exercise and this is echoed in the comparative score (IDV=60). They would be very careful of individual comments while in the group and were attentive of keeping the same pace as that of the group. UWL students in the UK scored an even lower figure (IDV=43), but given the mixed ethnic and cultural background, it could be argued that the presence of Asian students in the group affected the scores as can be seen in the individual responses.

Uncertainty avoidance was particularly evident in the difference in the style of teaching between ITAM (UAI= 38) and IITG (UAI= 73). During the workshop in IITG, certain elements of the theory were revisited prior to the activity taken place. These were delivered by us in the same style that they are delivered to UK students, which was to explain the theory and explain the task in relation to the theory. Feedback from the faculty staff indicated that this would not have been sufficiently structured for Indian students, who would expect a framework of theory, some examples, followed by a worked case study example. In contrast, Students in ITAM and DMU completed the activity independently at their own pace after a common induction and required minimum assistance to get them started. Low UAI score for Chinese students in this study (UAI=0) reflects also the same independence as ITAM students. Again a high uncertainty avoidance score for UWL (UAI=65) reflects the strong influence of the cultural expectations of students of Asian background (i.e. Pakistan, Sri Lanka, Nepal and India) in this group. During the session, these students at UWL required extra instructions as compared those from other backgrounds.

5.3 Analysis of Performance in Heuristic Task

At the time of writing this paper, we have analyzed heuristics richness for each student and all groups except for Mexico, which is still to be analyzed. Each student's response for each heuristic used to assess planteseed.com was coded using the scale presented in Table 1. The richness average for each institution is as follows: IITG (India)= 2.53, DMU (China)=2.23, PN (Namibia)=1.96, and UWL (UK)=1.83.

A pattern is emerging when noting the highest score for assessment richness belongs to the Indian student group. This group was the most balanced group in terms of cognitive styles, i.e. largely adaptive, which theoretically suggests they are better prepared to design usability with a balance of analytic and intuitive skills. Students from IITG also scored high in uncertainty avoidance (UAI=73), which is also in line with their effort of being less equivocal and more detailed in their assessment of each heuristic for the science education portal.

To validate the significance of group differences in evaluation richness an analysis of variance (ANOVA) was run by comparing the student performance means for each group. The results in Table 2 show a significant difference ($p<0.004$).

Table 2. Analysis of Variance Comparing Heuristic Richness Performance Between Groups

ANOVA

Richness

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.050	3	1.350	5.005	.004
Within Groups	15.644	58	.270		
Total	19.694	61			

The Tukey HSD Post-Hoc Test was applied to examine differences on a per group basis (Table 3). It can be seen the Indian group differed significantly from Namibian and UK results. This further supports our observation about the unique nature of IITG cohort and their ability to engage with tasks central to the HCI curriculum.

Table 3. Multiple Comparisons Test confirming significant difference of Indian group

Multiple Comparisons

Richness
Tukey HSD

(I) C2	(J) C2	Mean Difference (I–J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
China	India	-.29857	.18098	.359	-.7773	.1801
	Namibia	.26929	.18098	.451	-.2094	.7480
	uk	.39786	.18098	.136	-.0809	.8766
India	China	.29857	.18098	.359	-.1801	.7773
	Namibia	.56786*	.19630	.027	.0486	1.0871
	uk	.69643*	.19630	.004	.1772	1.2157
Namibia	China	-.26929	.18098	.451	-.7480	.2094
	India	-.56786*	.19630	.027	-1.0871	-.0486
	uk	.12857	.19630	.913	-.3907	.6478
uk	China	-.39786	.18098	.136	-.8766	.0809
	India	-.69643*	.19630	.004	-1.2157	-.1772
	Namibia	-.12857	.19630	.913	-.6478	.3907

*. The mean difference is significant at the 0.05 level.

6 Conclusion

This project is aimed at finding opportunities and challenges for the dissemination and enrichment of this discipline through eliciting and assessing the importance of students' cognitive styles and local cultures. It does so by exploring the context, performance and views of stakeholders involved in learning HCI. The preliminary findings presented here make visible the values and assumptions potentially shaping the learning of HCI and the preparation of better interaction designers.

While Hofstede's dimensions have been heavily criticized as valid indicators of national culture, we believe that their use at group level can introduce HCI educators to an initial reflection on the implications for students of the values, relations and interactions scripted in the content and delivery of HCI concepts and methods. In addition, our initial analysis of cognitive styles indicates an interesting tension between HCI as design subject and as an engineering subject. This leads us to another observation: the entry exams for some schools like ITAM or DMU will filter a particular type of student who will tend to be more of an engineer than a designer, therefore reducing the number of potentially 'ideal' HCI professionals.

The initial analysis of student performance for the assigned heuristic evaluation task indicates an emergent pattern linked to particular types of cognitive style and cultural dimension.

Once the qualitative phase of the analysis of student work begins, we hope to obtain richer insights that connect their outputs with the cultural and cognitive profiles presented in this paper. This project provides a unique opportunity to systematically compare and analyze data obtained from students in four continents. We are aware that it stands in different epistemological positions as it looks, on one hand, at performance and, on the other hand, at meanings used to represent and experience HCI. However, we see this as an opportunity for triangulation, co-validation and enhanced understanding of HCI education in a multicultural context.

References

1. Smith, A., Joshi, A., Liu, Z., Bannon, L., Gulliksen, J., Baranauskas, C.: Embedding HCI in Developing Countries: Localizing Content, Institutionalizing Education and Practice. In: Baranauskas, C., Abascal, J., Barbosa, S.D.J. (eds.) INTERACT 2007. LNCS, vol. 4663, pp. 698–699. Springer, Heidelberg (2007)
2. Nisbett, R.E., Miyamoto, Y.: The Influence of Culture: Holistic Versus Analytic Perception. Trends in Cognitive Sciences 9(10), 467–473 (2005)
3. Hayes, J., Allinson, C.W.: Cultural Differences in the Learning Styles of Managers. Management International Review, 75–80 (1988)
4. Hofstede, G.: Cultures and Organizations: Software of the Mind. McGraw-Hill, Berkshire (1991)
5. Sharkey, E., Paynter, J.: CHI education in New Zealand. Bulletin of Applied Computing and Information Technology 2(3) (2004), http://citrenz.ac.nz/bacit/0203/2004Sharkey_CHINZ.htm (retrieved February 28, 2013)

6. Gullisksen, J., Oestreicher, L.: HCI Education in Sweden. SIGCHI Bull. 31(2) (1999)
7. Kotzé, P.: Directions in HCI education, research, and practice in Southern Africa. In: CHI 2002 Extended Abstracts on Human Factors in Computing Systems (CHI EA 2002), pp. 524–525. ACM, New York (2002)
8. de Souza, M., Baranauskas, C., Oliveira, R., Pimenta, M.: HCI in Brazil: lessons learned and new perspectives. In: Proceedings of the VIII Brazilian Symposium on Human Factors in Computing Systems (IHC 2008). Sociedade Brasileira de Computação, Porto Alegre, Brazil, pp. 358–359 (2008)
9. Calderon, M.: Teaching Human Computer Interaction: First Experiences. CLEI Electronic Journal 12(1) (2009)
10. McSweeney, B.: Hofstede's model of national cultural differences and their consequences: A triumph of faith - A failure of analysis. Human Relations 55(1), 89–118 (2002)
11. Cloninger, C.: Usability experts are from Mars, graphic designers are from Venus. A list Apart (74) (2000), http://alistapart.com/article/marsvenus (retrieved February 28, 2013)