Embedding culturally relevant pedagogy in practice: Considerations for training and resource development

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ABSTRACT

As computer science (CS) is introduced to more learners across a variety of contexts (school, clubs, vocational settings), an emerging challenge is the need to ensure CS education is relevant and accessible to all. Culturally relevant pedagogy (or CRP) has emerged in recent decades as a dominant set of approaches for adapting learning materials to meet learners' needs and contexts. Where some research has taken place in formal settings (e.g. classrooms, schools), less is known about how these principles can be applied in non-formal settings, particularly in CS. In this paper, we detail how culturally relevant principles were applied in the adaptation and implementation of an introductory CS course at a refugee camp in Kenya. We report on how these principles were applied and how these influenced our work. Finally, we detail the implications for future practice in this area.

CCS CONCEPTS

• **Social and professional topics** → **Adult education**; **Informal education**.

KEYWORDS

computing education, non-formal, culturally relevant pedagogy, training, resource development

1 INTRODUCTION

The problem of under-representation in computer science (CS) education has prompted efforts to ensure it is both responsive and relevant to a wider group of learners [6]. Most notably, the use of culturally relevant pedagogy (or CRP) has been argued to promote more equitable outcomes for learners [4]. Proponents of CRP advocate that teaching resources created by those from relatively narrow demographic and cultural backgrounds bear little consideration of the culture and background of those who will be teaching or learning computing [3]. For instance, researchers at a computing club in a Palestinian refugee camp found that adapting to support participants was an ongoing challenge requiring consideration of the context in which the camp was taking place [1]. As such, these experiences can fail to serve the needs of those taking part.

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There is a growing body of evidence demonstrating the merits of applying CRP in education settings such as schools and colleges, where there are some clear similarities amongst the majority of learners such as age, geographic location and prior school experience. However, as content developers often create resources for a much broader demographic, challenges exist in adopting principles of CRP across broader learning contexts. In this paper, we detail insights into how we approached CRP in a non-formal educational context, for learners from under-resourced backgrounds, and how this impacted our current practices and future work.

2 BACKGROUND AND RELATED WORK

Many theories of cultural relevance have been proposed including CRP [4], culturally sustaining pedagogy [7], and, more specifically in CS, culturally responsive computing [9]. These theories share many commonalities, including a commitment to recognising the importance of learners' cultural backgrounds and encouraging teachers to create relevant learning experiences. However, conceptions about *what* CRP is and *how* it should be implemented can vary considerably. For instance, Codding et al. [2] found that conceptions of CRP differed substanially across computing education teachers reflecting the diversity of individual contexts. This suggests a careful consideration of the learning context is needed. In adapting computing to be culturally relevant, there are additional considerations not just for what content is taught, but which tools are used to support learning. For example, the use of computing equipment may be accessible to some learners while less for those with fewer experiences with digital devices.

2.1 Culturally relevant computing

Interest in the application of CRP in computer science education has also grown. Existing work in England has focused on how principles of culturally relevant (or responsive) teaching could be adapted for computing education practice [5]. Leonard et al. [8] developed a series of guidelines adapted for computing teachers and argued that a lack of cultural relevance (or responsiveness) could exacerbate problems of under-representation of minority groups in both access and achievement in computing education. More recently, Waite et al. [10] operationalised these culturally relevant principles into ten areas of opportunity (or AOs) that educators could use to review the cultural relevance of their current practices (see Table 1). These principles are broken up into four categories for reviewing learning experiences:

(1) **Participants:** Finding out about the learners and teachers/facilitators (AO1-AO2)

(2) **Content**: Reviewing the content, context and examples to ensure it is relevant and inclusive (AO3-AO4)
(3) **Pedagogy**: Considering how learning is being structured and presented to learners (AO5-AO9)
(4) **Policy**: Reviewing how policies or processes impact on the experiences of teachers/facilitators and their learners

Existing research on CRP, particularly in computing education, has mostly focused on the perspectives of learners and teachers in approaching culturally relevant learning experiences. However, the use of CRP frameworks, such as the AOs [10], could also provide a lens for curriculum developers to design learning content using CRP principles. Using this approach, we evaluate how the structure impacted content adaptation from a UK school setting to that of a vocational course at a refugee camp in Kenya. We review our resource development process, how content was adapted or created, and learners' and facilitators' experiences of the content, including any support and co-creation we undertake with facilitators.

3 STUDY

3.1 Context

Over six months, the Raspberry Pi Foundation worked in partnership with Amala Education to deliver a computing course to refugees in Kakuma, a large refugee camp in Kenya. The project involved developing 100 hours of computing content to be delivered over a 10-week period to 16–25 year olds. The course was designed to be vocational and based on a 60/40 split of classroom based and independent learning. Classroom-based sessions were led by facilitators. Both learners and facilitators spoke English (the language of the course materials) as a second language. The facilitators had a higher level of English than the learners. Throughout the initial stages of the project, we held regular meetings with the facilitators (weekly for cohort 1, monthly for cohort 2) and also held pre- and post-course focus groups with learners. This enabled us to check that the content we developed was accessible for both facilitators and learners and also make improvements based on their feedback. The content provided was a mixture of adapted existing materials, initially designed to meet the needs of the National Curriculum in England and new materials written specifically for this project. We considered a number of aspects when adapting and creating content to consider cultural relevance, including participants' age, level of English, cultural background, access to equipment, and prior experiences of the facilitators. In particular the learner-facing content needed to be heavily adapted so that it was suitable for the direct to learner context, whilst being linguistically and logistically accessible. Once the content adaptation was completed, we met weekly with facilitators who reviewed the material and gave feedback to prompt further iterations.

We initially developed a survey to share with learners and facilitators in the camp. This development phase provided us valuable insights into how access and prior experience with technology varied, what learners found relevant to them, and how they felt about using technology. This also yielded insights into the challenges facilitators faced in delivering the course content to the learners.

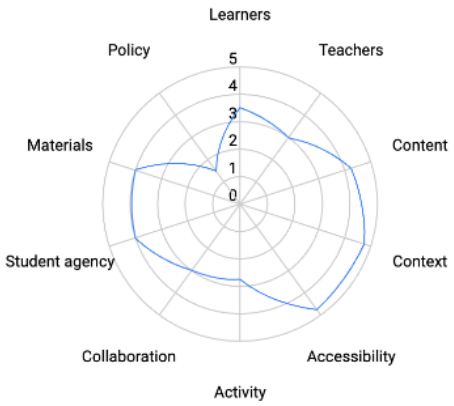

Figure 1: Relevance of AOs to project undertaken.

3.2 Data collection

We drew on the AOs outlined by Waite et al. [10] and applied these to the design and implementation of the course. Using these principles, we aimed to make learning materials more accessible and relevant to the setting. After implementation, we asked curriculum developers to reflect on which areas resonated most during adaptations and rank these using a 6-point scale (0 - Not at at all important, 5 - Very important). In our results and discussion, we discuss which of these areas provided most benefit.

4 RESULTS

We reflected on our use of CRP and our adaptations against the AOs. Curriculum developers were asked to rank each area against the adaptations made in developing the course; we plotted these to see how most adaptations were made (see Table 1). In the following sections, we detail the adaptations made and how they align to this framework. The use of each area of opportunity is referenced in brackets (e.g. AO1 = Area of opportunity 1).

4.1 Relevance of activities to learners (AO1/AO4)

We found that curriculum developers ranked the relevance of activities (or AO4) highly in making activities relevant to learners' context and needs. By undertaking a pilot survey with participants meant that the needs of learners could be better understood (AO1). For instance, we found that participants were keen to develop their computing skills as they valued the access technology provided (e.g. reading news online, searching for information, using social media). This allowed us to gauge participants' goals in participating in the course: many wished to develop independence by undertaking freelance work and they felt that completing the course would provide better opportunities both within and beyond the classroom.

Though the content was originally developed for different age groups, experience levels and even hardware, we found that our adaptations provided many relevant opportunities for learners, including socially relevant projects where learners created a website for 'social good'. This additionally meant considering what key

#	Category	Area	Description
AO1	Participants	Learners	Find out about learners in order to reveal opportunities to adapt our teaching
AO2		Teachers	Find out about ourselves as practitioners – to reflect on one's cultural lens
AO3	Content	Content	Review what is taught and add in extra culturally relevant content (e.g., about social justice/ethics, data bias accessibility etc.)
AO4		Context	Review contexts and examples used – to make teaching relevant, meaningful, to contextualise and make connections
AO5	Pedagogy	Accessibility	Make the content accessible and relevant
AO6		Activity	Provide opportunities for learners to think about user experience and alternate viewpoints, participate in open-ended, inquiry led, or problem-solving activities.
AO7		Collaboration	Develop student-oriented learning through collaboration and structured group discussion
AO8		Student agency	Develop student-oriented learning through student choice
AO9		Materials	Review the learning environment (including learning materials) – to increase accessibility, a sense of belonging and promote respect
AO10	Policy	Policy	Review related policies, processes and training in school or department

Table 1: Areas of opportunity (AOs)

skills were needed for learners to achieve these projects. For instance, the programming element of the curriculum was removed, so that more emphasis could be placed on digital literacy skills which would have greater application for learners. Using the AOs framework, we found that emphasising the experiences of learners (AO1) through conversations with learners and facilitators, making examples related to sustainability and social justice (AO3/AO4), and promoting opportunities for learners to collaborate together in project teams (AO7), all helped to support learners with different backgrounds find common areas of interest.

Though not explicit in the design of the course, we also found that learners developed innovative ideas for applying vector graphic design, including creating ID cards for them and others in order to prove their status in the camp. Facilitators also felt confident enough to adapt content with more relevant examples or to help their learners understand the content. Likewise, other learners reflected on how their skills could be applied in different contexts. Several learners indicated that website design was most beneficial, enabling participants to develop social entrepreneurship ideas.

4.2 Scaffolding learners with additional language needs (AO5)

Curriculum developers were also interested in the accessibility of material (AO5), particularly in supporting learners with additional language needs. We adapted the training materials to scaffold participants with English as a second language (AO5). For instance, videos in the original set of resources were animated with text-based captions. For the adapted content, we provided spoken explanations and subtitles to aid comprehension. *Text Inspector*[1] was used to analyse the readability of language used in the course. This allowed learning-facing materials and facilitator instructions to be checked but also introduced challenges where technical language (i.e. computing terminology) was needed.

[1]https://textinspector.com/

4.3 Adapting for lack of materials (AO9)

A lack of equipment meant that activities needed to be carefully adapted (AO9). For instance, no centralised screen or projector was available in the classroom. Facilitators shared their insights, including describing restrictions of the classroom environment in which internet access can be intermittent and hardware is unreliable. Instead of displaying on a large screen, we adapted activities to encourage learners to view each other's work on individual screens. Likewise, activities were designed for use with tablet-based applications to avoid the need to transfer large video files to and from computers where the network infrastructure was unreliable.

4.4 Consolidating course content (AO1)

The curriculum content was also adapted to be more suitable for older learners (AO1). We combined learning sequences into richer experiences with more rapid progression, whilst using language in line with learners' level of English. To account for a busy schedule, we contracted 9 hours of content initially developed for 5–8 year old learners in England to 2 hours for 16–25 year old learners (see Figure 2) in Kenya. The blocks marked 'P' provided context for younger learners but were not necessary for older learners. We also adapted the goals of some activities (e.g. using a mouse to paint a digital picture) to more longer-term goals (e.g. using a mouse as part of a series of activities designed to improve general digital skills). As such, efforts to be more culturally relevant in this context meant focusing on the intended content (both learning content and contexts) and pedagogy [10] to better support learners' needs.

Through the adapted course, learners were supported to gradually develop skills in creating a website in HTML using different media. This progression introduced concepts such as computers and networking, with key skills such as desktop publishing, vector graphics and video editing. Adapting this progression meant balancing a lack of prior experience and introducing new skills to older learners; we therefore offered more opportunities for independent tasks so that the content could be completed in the allocated time. Learners could also use their interests and life experience (AO6)

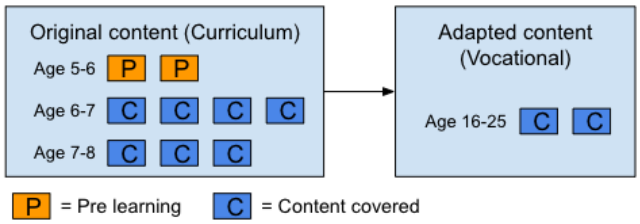

Figure 2: Consolidation of content to meet the needs of older learners.

and were given agency to complete activities such as creating webpages and deciding on content independently or in groups (AO8) or choosing their own roles and responsibilities during activities.

5 DISCUSSION

Adapting a course for a refugee camp meant that being culturally relevant was our primary goal. We found applying the areas of opportunity framework [10] useful in reflecting on how principles of CRP were employed in course development. Multiple cycles of iterations were required to make the course content more culturally relevant. Likewise, it enabled us to see where we *hadn't* made adaptations (see Figure 1. For instance, adapting for teachers (AO2) was less important to curriculum developers due to the fact that a significant portion of the content (40%) was designed for self-directed learning (i.e. without a facilitator). Policy concerns were also rated lowest which was expected given that this project was not related to a formal curriculum.

In order to achieve the goal of being culturally responsive, Gay [3] argues that culturally relevant teaching should emphasise the cultural knowledge and experiences of learners. Surveying the intended participants during the early stages of the project meant that we could better adapt content to be accessible, particularly as the content was originally developed for young learners in England. As learners had limited prior experience with digital devices, we tailored learning outcomes to develop their digital literacy skills; this meant we could ensure that enough time was allocated to prerequisite skills. The adapted course was received positively by multiple cohorts with future courses planned. Course facilitators detailed examples of learners applying their skills to create digital artefacts which practically help them on a daily basis. The vocational course is currently in its third iteration with previous learners both serving as course facilitator and having secured jobs in the technology industry.

In future work, we intend to use the insights gained on the opportunities and challenges of CRP and how these could support work in other courses. For instance, we are currently developing multiple training programmes in digital making activities for youth leaders in the UK and a coding academy curriculum to support under-resourced young people in Telangana, India.

5.1 Limitations

The main limitation was that curriculum developers were unable to gather primary data in the study context. As the project took place in Kenya, this meant that online interviews were held with course facilitators and these were used to prompt reflection among the curriculum developers.

6 CONCLUSION

Using culturally relevant pedagogy in our work provided some benefits. By applying the AOs to the adaptation and delivery of a vocational computing course, we illustrate the application of CRP in a non-formal educational setting. We argue that employing CRP can yield positive outcomes for learners but caution that these applications require a careful consideration of the cultural contexts where they are applied.

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REFERENCES

[1] Konstantin Aal, George Yerousis, Kai Schubert, Dominik Hornung, Oliver Stickel, and Volker Wulf. 2014. Come_in@palestine: Adapting a German Computer Club Concept to a Palestinian Refugee Camp. In *Proceedings of the 5th ACM International Conference on Collaboration across Boundaries: Culture, Distance & Technology* (Kyoto, Japan) *(CABS '14)*. Association for Computing Machinery, New York, NY, USA, 111–120. https://doi.org/10.1145/2631488.2631498

[2] Diane Codding, Chrystalla Mouza, Lori Pollock, and Scott Sheridan. 2019. Culturally Responsive and Equity-Focused Computer Science Professional Development. In *Proceedings of Society for Information Technology & Teacher Education International Conference 2019*, Kevin Graziano (Ed.). Association for the Advancement of Computing in Education (AACE), Las Vegas, NV, United States, 648–656. https://www.learntechlib.org/p/207711

[3] Geneva Gay. 2000. *Culturally responsive teaching : theory, research, and practice.* Teachers College Press, New York.

[4] Gloria Ladson-Billings. 1995. Toward a Theory of Culturally Relevant Pedagogy. *American Educational Research Journal* 32, 3 (1995), 465–491. https://doi.org/10.3102/00028312032003465

[5] Hayley Leonard, Sue Sentance, Diana Kirby, Linda Chinaka, Michael Deutsch, Yota Dimitriadi, and Joanna Goode. 2021. Localising culturally responsive computing teaching to an English context: developing teacher guidelines. In *Understanding computing education Theme: Equity, diversity and inclusion in computing education.* Understanding computing education, Vol. 2. Raspberry Pi Foundation, Cambridge, UK. https://www.raspberrypi.org/app/uploads/2021/12/Understanding-computing-education-Volume-2-Raspberry-Pi-Foundation-Research-Seminars.pdf

[6] Hayley C Leonard and Sue Sentance. 2021. Culturally-relevant and responsive pedagogy in computing: A Quick Scoping Review. *Int. J. Comput. Sci. Educ. Sch.* 5, 2 (Dec. 2021), 3–13.

[7] Django Paris. 2012. Culturally Sustaining Pedagogy: A Needed Change in Stance, Terminology, and Practice. *Educational Researcher* 41, 3 (April 2012), 93–97. https://doi.org/10.3102/0013189X12441244

[8] Raspberry Pi Foundation. 2021. *Culturally relevant and responsive A guide for curriculum design and teaching.* Raspberry Pi Foundation, Cambridge, UK. https://static.raspberrypi.org/files/research/Guide+to+culturally+relevant+and+responsive+computing+in+the+classroom.pdf

[9] Kimberly A. Scott and Mary Aleta White. 2013. COMPUGIRLS' Standpoint: Culturally Responsive Computing and Its Effect on Girls of Color. *Urban Education* 48, 5 (Sept. 2013), 657–681. https://doi.org/10.1177/0042085913491219

[10] Jane Waite, Anjali Das, Hwang Yujeong, and Sue Sentance. 2023. Culturally relevant Areas of Opportunity for K-12 computing lessons. In *2023 IEEE Frontiers in Education Conference (FIE)*. IEEE, College Station, Texas, USA. In press.