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Teaching Future-Makers: Outcomes of an International Design Workshop for Critical Action Educators

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Abstract: This paper reports on recent developments of the Critical Action Learning Exchange (Carvalho et al., 2021), an international community of educators who seek to respond to social and environmental issues that affect their students. We report on an international design workshop that engaged a cohort of teachers in designing Critical Action Learning activities for their students in the Summer of 2023. Participants (n=39) completed 16 curriculum designs for grade levels from kindergarten to university, addressing a broad range of socio-environmental issues and adopting diverse approaches, such as Arts-Based Critical Action, Community Engagement, Critical Making, Games for Critical Action, and Storytelling. This paper examines our Professional Development model, together with an analysis of teacher participants' ideas and their design products. We investigate what forms of scaffolding can facilitate the changes of practice needed for teachers to become critical action educators and support their Critical Action Learning designs.

Introduction

This paper reports on recent developments of the Critical Action Learning Exchange (CALE; Carvalho et al., 2021), an international community of educators motivated to respond to pressing socio-environmental issues (e.g., climate change, discrimination, war, poverty and inequality, etc.) that affect their students and communities. CALE has been advancing a Critical Action Learning (CAL) framework that provides theoretical and technological support to educators interested in responding to such problems and empowering their students. We have developed CAL as a practicable means for teachers to empower students as transformative agents–in Freirean terms, "future-makers" (Freire, 1993)–capable of taking action in response to such problems. In the Summer of 2023, CALE succeeded in helping a cohort of teachers design critical action learning activities and assessments for their students. This was the third international workshop offered by CALE, but the first in which we found real success in helping teachers achieve their designs. We attribute this success to the improvements our design-based research process produced across the multiple iterations (Carvalho et al., 2022), the maturing of the community throughout the years, and our adoption of Design-Based Implementation Research, which guided our investigation of the following research questions, 1) What forms of scaffolding can help teachers become critical action educators?; and 2) How can rapid cycles of design enable teachers to reflect on important pedagogical ideas relating to critical action, and ultimately to succeed in applying those principles to the design of new curriculum? Below, we present the CALE Professional Development (PD) model, together with an analysis of teacher participants' ideas and their designed curricula.

Theoretical framework

Critical Action Learning (CAL)

CALE has developed the Critical Action Learning (CAL) pedagogical approach, which draws from Knowledge Building (KB) theory and Critical Pedagogy (CP) (Carvalho et al., 2021). KB recommends a series of practices and principles that foster epistemic agency and collective responsibility to promote continuous improvement of ideas through dialogue and joint investigation (Scardamalia, 2002). Furthermore, KB theory provides a conceptualization of two distinct modes of engaging with knowledge and ideas, described as 'belief mode' and 'design mode' (Scardamalia & Bereiter, 2017). Belief mode refers to the stance we assume when evaluating knowledge claims and deciding what to believe, while design mode refers to the mindset we adopt when innovating, creating new knowledge, or advancing an idea. This characterization shares similarities with CP's

philosophy of 'praxis,' which stresses the importance of the educative process to interweave theoretical reflection and transformative action (Jemal & Bussey, 2018). CP's concept of 'praxis' manifests in the "problem-posing model" of education proposed by Freire (1970), which reframes inescapable "realities" as actionable "problems." Both KB and CP conceptualize epistemic shifts that are instrumental for critical action educators to design curricula that afford opportunities for students to engage in critical reflection and transformative action toward complex problems.

Professional Learning Communities (PLCs)

The research literature describes professional learning communities (PLCs) as groups of professionals collaborating in an ongoing, learning-oriented, critical interrogation of their practice (Toole & Louis, 2002). Hipp et al. (2008) argue that success in establishing such a community "requires informed and purposeful action based on learning." Supovitz and Christman (2003) stress the need for the community to be grounded in supportive structures and strategies. PLCs may offer a powerful context for the professional development of teachers, with opportunities for knowledge building, collaborative design and exchange of resources, new curricula and teaching practices, social and emotional support, and continuing development of one's professional identity. Research has explored the dynamics of such communities, including motivations for joining and participating (Prevo, 2014) and factors for successful knowledge building (Tan, Chue & Teo, 2016). Research on teacher PLCs has sought to identify factors that make these communities effective. Five characteristics of effective PLCs are often mentioned: (1) shared values and vision, (2) collective responsibility, (3) reflective professional inquiry, (4) collaboration, and (5) collective advancement (Fullan, 2001). Research also suggests that teacher PLCs contribute to instructional improvement and school reform (Little, 2002) and increase classroom motivation and work satisfaction (Louis et al., 1995).

Methods

Design-Based Implementation Research (DBIR)

Our study employs Design-Based Implementation Research (DBIR; Penuel et al., 2011) to structure the collaborative work of both researchers and practitioners addressing problems of practice through iterative design and testing of innovations. Through this process, participants build knowledge, theories, and innovations to produce sustainable change in educational settings. DBIR builds on two approaches to education research: (1) Design-Based Research (DBR), which examines design as a primary mode and outcome of research, reflecting the complexity of the learning context; and (2) Implementation Research, which examines how, when, and why innovative practices can be effectively implemented, and whom they benefit. DBIR allows for an expansion of the scale of the research (when compared to DBR, which is typically focused on smaller systems, such as the classroom) by facilitating the design and testing of novel supports for the implementation of reforms (Penuel and Fishman, 2012). Penuel and Potvin identify four principles of DBIR: "1) a focus on persistent problems of practice to address concrete goals for improvement from multiple stakeholders' perspectives; 2) a commitment to building and testing innovations through iterative, collaborative design; 3) a concern with developing theory and knowledge related to both classroom learning and implementation through systemic inquiry; and 4) a concern with developing capacity for sustaining change in systems." (2021). Our study applies DBIR to the research of how teachers' sustained change of practice when becoming critical action educators can be facilitated. Over the past three years, participants have engaged in the collaborative development of a series of supports for CAL curriculum design and enactment, such as (1) teaching resources, including a library of lessons designed by CALE teachers and a large pool of Web resources; (2) professional development, including a MOOC (Massive Open Online Course), workshops, curriculum framework, design guides, and peer mentoring opportunities; and (3) an online community platform for peer support, collaborative design, implementation, exchange, and advancement of curriculum. While in previous papers we have reported on these developments (Carvalho et al., 2021; 2022; 2023), this paper focuses on the outcomes of teachers' collaborative design work using these resources and discusses how they succeeded in incorporating new pedagogical ideas relating to critical action to the design of new curriculum.

CALE professional development

In 2023, CALE organized an online workshop attended by 39 participants from 14 countries. The participation was free of charge, and recruitment was made through social media and direct contact with previous years' participants. Participants teach all levels (from kindergarten to higher-ed) and a broad range of subjects, including STEM, social sciences, languages (English, ESL, Hindi, Icelandic, and Mandarin), teacher education, computer sciences, business, and architecture. Activities were conducted in four sessions in the span of two weeks.

Data analysis

We collected data from entry and exit surveys, video recordings of the PD sessions (including Zoom breakout rooms), discussions on the CALE online platform, and design documents created by participants. This particular study focuses on the analysis of the design documents, which include (1) presentation slides created by participants to present their initial ideas to the whole group to obtain peer feedback, and (2) the final designs created and shared on the CALE curriculum authoring tool. The design documents were analyzed independently by two researchers, who rated them based on how effective they were in incorporating each of the six components of the CALE pedagogical framework (Carvalho et al., 2023). This framework is a conceptual tool that helps educators design opportunities for students to make progress in six aspects of CAL: 1) *Knowledge*: how students build their understanding of the issue they are addressing; 2) *Criticality*: how students envision desired improvements on the issue; 3) *Action*: how students act to realize their envisioned improvements; 4) *Individual*: how each student contributes with their unique skills and experiences to the collective action; 5) *Community*: how students coordinate their individual contributions; and 6) *Globe*: how the student community connects their actions with other initiatives outside the classroom. The interrater agreement was 92%, with nearly all disagreements involving a difference of only one degree. In cases where the two raters disagreed, they met to determine an agreed-upon measure.

Outcomes

Advancements to the CALE professional development model

CALE has advanced a PD model that engages members in design workshops where they advance their notions of CAL, discuss problems of practice and engage in collaborative design of curriculum. Since 2020, CALE has offered a series of workshops in Canada, China, and India, employing DBIR principles to iteratively advance its PD model. In this section, we discuss the design iteration implemented in the 2023 CALE Summer Institute (CALE-SI). As in the 2022 iteration, the 2023 CALE-SI was conducted totally online, to allow for the participation of educators from around the world. As in 2022, when we held four 3-hour meetings, once per week over four successive weeks, the 2023 workshop also comprised four three-hour sessions. However, this year we held them over a 2-week span, meeting on Tuesdays and Wednesdays over two consecutive weeks. This schedule proved to be more convenient for teachers who had to dedicate only two weeks of their time over the Summer for comparatively more intensive work. Another important innovation of the 2023 CALE-SI was inspired by discussions with a veteran CALE teacher, who argued that teachers should be engaged immediately in design activities, as this would help them develop a better sense of the ideas, and maintain some motivation and a sense of progress. We determined that each session should include opportunities for the participants to advance in three aspects, in parallel: (1) the sense of community (i.e., building trust and relationships with other participants, exploring cross-cultural perspectives and shared interests, becoming familiar with the technology support for collaboration, etc.), (2) the advancement of CAL theoretical understandings, and (3) the collaborative design work on critical action curriculum. To accomplish this design, we included a series of new features. For the sense of community, we asked veteran CALE teachers to present designs they had developed in previous years. This also served to advance theoretical understandings, as the presentations provided exemplars of successful designs, and generated opportunities for theoretical discussions. To allow for collaborative design work, we allocated time for small-group design work in breakout rooms with peer mentors (who stayed in touch throughout and after the workshop). We also introduced a new technology environment for design and authoring, discussed below. The parallel advancement of these components, as well as the 2-week more intensive schedule, led to outcomes significantly different from the 2022 edition. On one hand, the time available for asynchronous work was drastically decreased, since that kind of work happens in the time between sessions and the participants were limited to only one week for such asynchronous discussions. On the other hand, partnerships were established quickly, and design work started on the first day of the workshop, with significantly improved results. While in 2022, participants collaboratively developed only six curriculum designs, in 2023, we saw 33 designs initiated, and 16 designs fully completed by the end of the workshop. The teachers were clearly engaged, even after the workshops were completed, and the CALE research team was struck by the overall level of success.

Technology environment

The 2023 CALE-SI was supported by a web platform to mediate teachers' reflexive discussions, as well as curricula designing and sharing. This platform includes an authoring tool for design teams to develop critical action lessons. This tool incorporates the CALE Framework and scaffolds lesson plan designs, facilitating the incorporation of the framework's six components into the design. The authoring tool includes seven major sections: (1) Overview of Team, including members, topic and age level of students; (2) Getting Started, in which teachers reflect on issues confronting their students, such as climate change or food insecurity, and define a critical action challenge that can guide their design; (3) Learning Goals, in which they articulate the specific content, competencies, and perspectives they wish students to gain, how the curriculum will empower students, and what

some of the main activities will be; (4) Approaches and Resources, which could be one or more of the CALE approaches, links to websites, other projects, or student resources; (5) Fitting the Framework, in which the six components of the CALE framework are outlined in terms of guiding questions to help teachers fit their designs into those elements; (6) Outline of Activities, in which they further explicate a sequence of curriculum activities; and (7) Enactment Plan in which they articulate some details of when the curriculum will run, what class of students, any remaining challenges or concerns, and final to-do list. The platform also allows teachers to share their designs and adapt other teachers' designs to their particular contexts, and includes a discussion area in which teachers can discuss socio-environmental issues (i.e., climate change, social justice, etc.) and CAL approaches, as well as share resources, ask for support, etc.

Critical Action curriculum designs

During the workshop, participants started a total of 33 curriculum designs for grade levels from kindergarten to university in a broad range of subjects. At the end of the workshop, 16 designs were completed and will be analyzed here. Over the past several years, CALE has systematized five approaches for CAL: Arts-Based Critical Action, Community Engagement, Critical Making, Games for Critical Action, and Storytelling (Carvalho et al., 2023). This year's designs utilized all five of the approaches, and some mixed together multiple approaches. In the following sections, we describe each approach to help the reader understand the specifics of critical action learning, and discuss some examples of how each approach was utilized in the 16 designs created during this year's workshop. We also analyze how effectively each design incorporated each component of the CALE Framework.

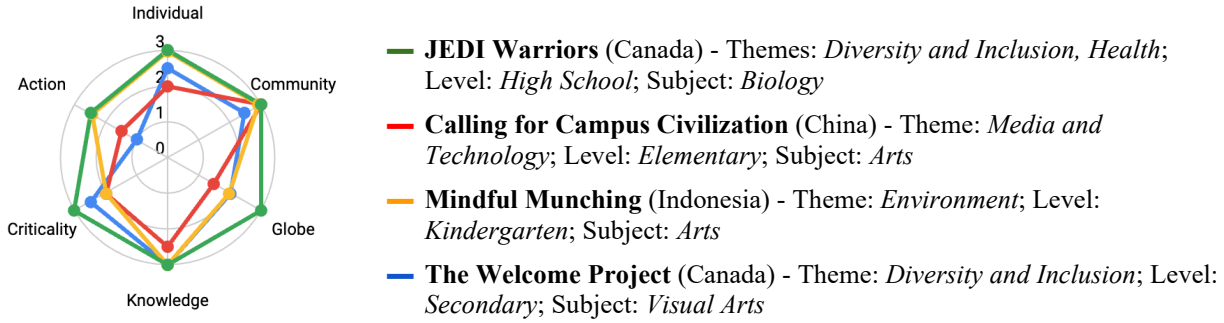
Arts-based Critical Action

This approach offers a vehicle for students to communicate ideas and express their identities in an intellectually and emotionally engaging way. Arts-based methods may help students develop more richly connected understandings and appreciate the diversity of viewpoints and values that exist among their peers (Keifer-Boyd, 2011). As a CAL approach, the Arts can be especially effective when the student's creative and critical expression reaches others, helping an audience of peers gain insight into the values and lived experiences of the students/artists. By curating a whole classroom's creative product, the teacher can help create a tapestry of students' expressions. Students can also invite the audience to participate, leaving their own voice, which influences the creative products.

Four curriculum designs using this approach were developed during the workshop (Figure 1). The *JEDI Warriors* unit incorporates Arts-Based Critical Action into a Grade 11 Genetics curriculum for a school in Ottawa, Canada, to address issues of Equity, Diversity, Inclusion and Justice (EDIJ). In *JEDI Warriors*, students evaluate the importance of recent contributions to our knowledge of genetic processes and analyze social and ethical implications of genetic and genomic research. Students then create illustrations to represent their own identities and the inequities in the healthcare system. Another curriculum design, titled *Mindful Munching,* adapts CAL to the cognitive developmental stage of kindergarten children in a school in Bali, Indonesia. Through the span of six weeks, children use the arts to explore the trajectory of food from the farm to the market, to the table, to waste management.

Figure 1

Arts-Based Critical Action Curriculum Designs, Showing the Level of Emphasis on Each Component of the CALE Design Framework, as Scored From 0 (none) to 3 (extensive).



Community Engagement

Community Engagement empowers students by engaging them directly with the socio-environmental issues that concern them personally, as well as their families and local communities (Ozer, 2017). Through this approach, students cooperate with organizations and community members to generate positive transformations. Community Engagement is a cyclical process of learning and action in which students work in small groups or individually to

conduct their own research, brainstorm ideas, survey community members, and develop designs that respond to problems they care about. Community Engagement democratizes the learning experience, giving students ownership of expertise by recognizing that young people are capable of producing knowledge that leads to transformative action. This approach acknowledges that youth have a stake in their community and that their voice can matter.

Four designs using Community Engagement were completed during the workshop to address themes such as climate change and other environmental issues, economic inequalities, and the future of work (Figure 2). For example, *Dongguan Coastal Mangroves* connects students with the communities in the coastal areas of Dongguan, China. Students learn about the importance of the local mangrove biome and engage in action for its conservation. Another example is *Data Pirates,* a secondary-level Statistics curriculum from Bangalore, India, in which students engage directly with their communities to collect socioeconomic data, then use the Statistics concepts they learned to analyze the data and create reflective journals that will be shared back with the community.

Figure 2

Community Engagement Designs, Showing the Level of Emphasis on Each Component of the CALE Design Framework, as Scored from 0 (none) to 3 (extensive).

- **The Problem of Yunshan Bridge** (China) - Theme: *Environment*; Level: *Grades 1 to 12*; Subject: *STEM*
- **Data Pirates** (India) - Theme: *Economy; Work*; Level: *Grade 10*; Subject: *Math*
- **Dongguan Coastal Mangroves** (China) - Theme: *Climate Change*; Level: *High School*; Subject: *Science*
- **Career planning through shadow mentoring** (China) - Themes: *Work*; Level: *High School*; Subject: *Career development*

Critical Making

Critical Making includes but is not limited to crafting cardboard creations, and making with paper circuits, Arduinos, Raspberry Pis, and web tools (Gerstein, 2019). Critical making emphasizes the situated, context-specific, and material selection aspects of the design process (Ratto, 2011). This approach helps teachers and students explore the relationship between process and end product, the role of collaboration, the entanglement of theory and practice and connections between makers and communities. Critical Making contributes toward critical action by putting the human experience above the technological one and making a conscious effort to make space for thoughts, emotions, and feelings to permeate and leverage the resources available at the maker's disposal. Students collaboratively engage in identifying their own as well as their audience's needs, interests and voices, and can examine important issues or themes, including inequities or other systemic factors (e.g., against gender or race).

One design employed the Critical Making approach to address issues related to unhealthy food habits was completed during the workshop (Figure 3). The V*egetable Garden Project*, involves students of a Chinese secondary school in critical reflection on nutritional habits while they design and develop technology that improves the school's vegetable garden (e.g., watering and drainage systems, etc.).

Games for Critical Action

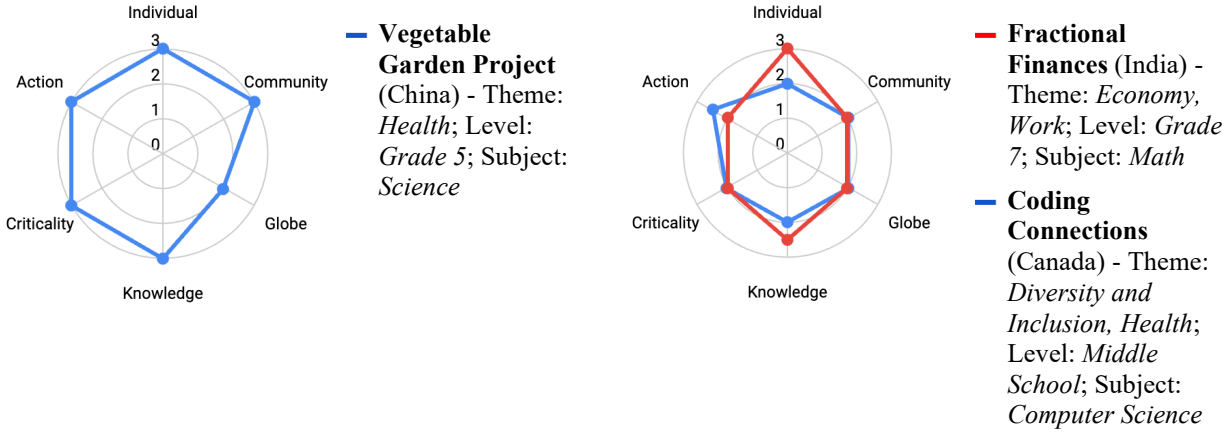
Although research has demonstrated some effective uses of games in education (Miller, 2008; Randel et al., 1992), their use in the specific context of CAL can be more difficult. One aspect that can make it challenging to use games for CAL is that the consequences of an action that happens in a game context are usually confined to the gameplay situation (i.e., when the princess is saved in a videogame or a crime is solved in a boardgame, no actual princess gets saved or crime, solved). Some games do encourage players to take action in the real world (e.g., "Habitat the Game" encourages environmentally conscious attitudes, and "Half the Sky Movement" promotes gender equality), but these are less common. On the other hand, games afford opportunities to simulate distinct realities and outcomes that can be critically analyzed. Also, since game rules don't necessarily have to adhere to the rules and social conventions and structures of the real world, games offer unique opportunities to experiment with alternative realities and concepts. Finally, games' replayability creates opportunities for players to critically reflect on how different choices may lead to different results (Dhiman, 2023).

Two designs developed during the workshop made use of this approach (Figure 3), addressing issues related to work, as well as diversity and inclusion. *Fractional Finances* transformed an Elementary Math

curriculum on Fractions that was usually taught through a traditional lecture-based approach in a school in Bangalore, India. The teacher devised a simple game in which groups of students are given different amounts of "money" (in the form of plastic beads), representing the income ranges of Indian households. Students are then asked to plan the families' budgets by allocating fractions of their income to each expense category (e.g. health, food, housing, leisure, etc.). Finally, students will reflect on economic inequalities, career paths, etc. The second design, *Coding Connections*, engages middle school students in Canada using Scratch coding to recreate a digital version of the traditional Indian music game "Antakshari," which they will then play to explore topics related to gender inequity in tech fields.

Figure 3

Critical Making (left) and Games for Critical Action (right) Curriculum Designs, Showing the Level of Emphasis on Each Component of the CALE Design Framework, as Scored from 0 (none) to 3 (extensive).



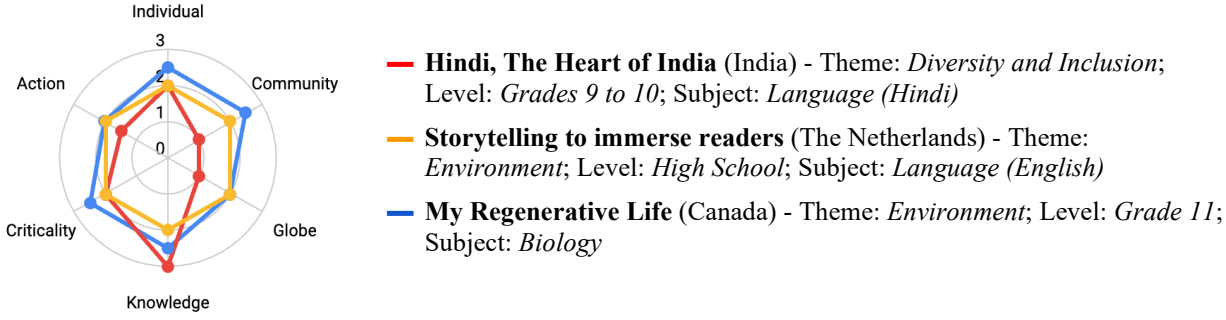
Storytelling

Storytelling has been used to empower and engage students in crafting their own stories that connect learning with their own lived experiences, bringing forward multiple perspectives and artistic interpretations, and allowing teachers to build on the breadth of ideas to support an inclusive learning environment (Burk, 2000). As an approach for CAL, Storytelling allows students to adopt a critical perspective in which they interpret and respond to the world in relation to a particular topic or issue, adding their voice to the communities in which they may otherwise feel silent or silenced. The empowerment provided through telling one's own story can help students create new and more positive understandings of their own lives in relation to school subjects. Moreover, by reflecting on peers' stories, as well as their own, students can widen their own understandings, build meaning, and gain insight into possible actions, career directions, political or cultural movements, etc.

There were three Storytelling lessons created, addressing topics related to the environment, as well as diversity and inclusion (Figure 4). *My Regenerative Life* is a high-school transdisciplinary unit that engages students in Toronto, Canada, in creating stories that imagine their city in the year 2040. Students are invited to tell the story of their lives in a future in which their city is dedicated to regenerative efforts in multiple areas, such as rethinking energy, educating girls, using permaculture and regenerative agriculture to purify air, water and soil, and more. In *Hindi: The Heart of India*, students who have Telugu as their first language will get more proficient in Hindi by collecting and crafting stories from and about the many regions of India.

Figure 4

Storytelling Curriculum Designs, Showing the Level of Emphasis on Each Component of the CALE Design Framework, as Scored from 0 (none) to 3 (extensive).

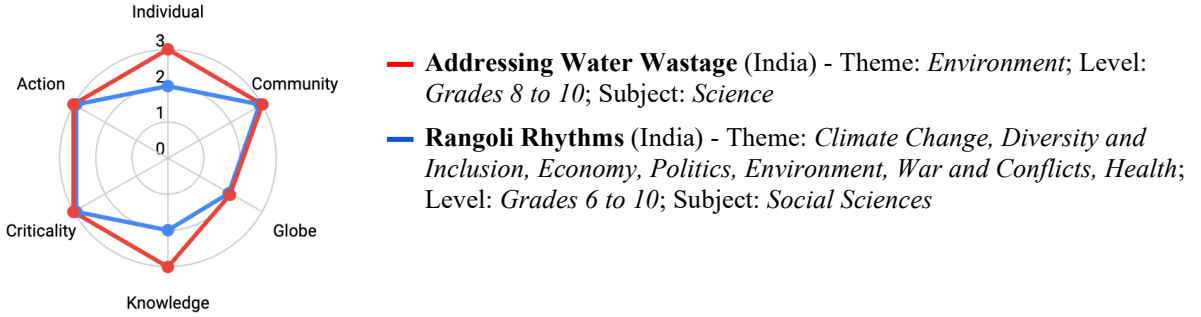


Mixed approaches

Finally, two designs combined two or more CAL approaches in different ways (Figure 5). *Rangoli Rhythms* engages secondary students in India in the traditional art form of 'rangolis' (i.e., intricate drawings made on the floor with coloured sand and other materials). Groups of students explore social issues that affect themselves and their communities (e.g., rural-urban divide, caste and social discrimination, socioeconomic disparities, etc.) and create rangolis that express their critical reflection on those problems. Students also reach out to their communities to lead art workshops, enabling them to share their knowledge and advocate for change, and facilitating the creation of a large-scale art installation. In another example, the *Addressing Water Wastage* project engages secondary students at the same school in India in critical reflection and action regarding water conservation. Students collect data about the usage of water in the school, design awareness materials, use critical design to engineer solutions for water reuse and collaborate with school management for installing rainwater harvesting systems.

Figure 5

Mixed approaches curriculum designs, Showing the Level of Emphasis on Each Component of the CALE Design Framework, as Scored, as scored from 0 (none) to 3 (extensive).



Discussion and conclusion

As global socio-environmental problems grow more complex and urgent, critical pedagogies are becoming increasingly attractive to educators. However, their practical use in classrooms is often elusive and challenging to enact. Our multi-year research project, of which the 2023 CALE-SI was the most recent iteration, has the overall goal of advancing CAL as an accessible pedagogical approach for empowering students as transformative agents. In this study, we have applied DBIR to design, implement and test a series of features that advance the CALE PD model. These resources proved effective in helping teachers co-design CAL curricula appropriate for different grade levels and subjects, using diverse approaches to address a broad range of socio-environmental issues. The refined workshop model, designed to advance in parallel (1) the sense of community, (2) the participants' theoretical understandings of CAL, and (3) the curriculum design work, was instrumental in helping participants incorporate CAL into their teaching practice. As a next step, we will support and study the classroom implementations of the designs created during the workshop. We are also developing new features to be added to the CALE platform, so teachers can report back to the community on their curriculum enactments, discuss successes and challenges, and learn from each other's experiences.

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