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Family Matters: Funds of Knowledge in the Design of Culturally Affirming Computational Thinking Assessments

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Abstract: In this paper we describe our approach, working with families, teachers, and students to assess K-2 students' computational thinking leveraging their funds of knowledge (FoK). We describe three unplugged (non-digital) tasks including (a) the FoK each task sought to leverage; (b) the computational thinking skills the tasks intended to assess; and (c) the extent to which each task was successful based on seven criteria (interactiveness, immersiveness, adaptability, inclusivity, alignment with CT, functionality, accessibility). Across all three tasks, we found that students' and families' experiences and routine everyday practices can provide rich context and inspiration for the development of culturally affirming assessment tasks.

Keywords: Funds of knowledge, Culturally-affirming assessments, Computational thinking, Early childhood, Formative assessments

Introduction

Consider this scenario, anonymized and fictionalized to protect the protagonist's privacy.

One Saturday afternoon, while mom tended to the family garden and dad prepared his famous stew, six-year-old Ebony was asked to watch over her younger brother Josiah. She decided the best way to keep him occupied and out of trouble was to build them a fort in the living room. Inspired by the castle she had seen in her favorite picture book, Ebony envisioned a grand structure that would be their secret hideaway and began to lay out the necessary steps in her head. Armed with a pile

of blankets, cushions, and a handful of clothespins, she set out to bring her vision to life. Ebony began by assessing her resources. She knew from past attempts that stability was crucial to prevent the fort from collapsing. She carefully evaluated the couch, coffee table, and chairs, considering how each could serve as a pillar or wall. Ebony decided that the couch would be the main support because it was sturdy and had a high back perfect for securing blankets in place. With the pillars in place, Ebony moved on to the walls of her fort. She experimented with various blankets, comparing their sizes and weights to determine which ones would provide the best coverage without sagging. As she draped a large quilt over the structure, she noticed it had a tendency to slip. Thinking quickly, she grabbed some clothespins and used them to secure the quilt to the chair legs, solving the stability problem. Ebony realized she needed an entrance and designed a curtain from a smaller blanket, which she tucked between two pillows for easy access. She then moved inside the fort to solve the problem of the limited space (it needed to hold her and her brother), creating a cozy layout by arranging cushions strategically along the walls for both comfort and additional support. Satisfied with what she had created, Ebony noticed that she didn't have enough light, so she grabbed a flashlight and placed it in a jar to diffuse the light, illuminating the fort from within. Once complete, Ebony stepped back and declared that this fort was, in fact, the best fort she ever built.

For Ebony, building the fort was an afternoon of creativity and play - an activity she had engaged in many times before as she looked after her baby brother. Yet, she unknowingly employed complex computational thinking skills throughout her project. She abstracted her vision into manageable parts, decomposed tasks such as structure stability and light enhancement into a step-by-step process (algorithmic thinking), and designed an elegant solution for each challenge she faced (debugging). While Ebony (and her brother and parents) saw the fort as a play space, her problem-solving and algorithmic thinking reflected foundational elements of computational thinking, an area of computer science focusing on solving everyday problems in systematic ways. Ebony leveraged her prior knowledge and experience with building forts, creating cozy spaces, and manipulating light sources to create something new and better. And because she had this prior knowledge/experience, she did not panic when she met a challenge. Instead, she drew on that prior knowledge to solve the problem at hand.

Of course, formal knowledge consists of theories and conventions specific to each discipline, which we must learn and understand in terms of their application and context; but learning also involves integrating individual experiences. We retain knowledge better when we can link new information to something familiar (Anderson, 1984; Piaget,1970). These informal (or lived) experiences are not just supportive to learning, they are integral to learning. And, if we accept that everyday experiences are an essential part of learning, then we must also accept that students will struggle to learn - and to demonstrate what they have learned- if they cannot integrate formal content with their own everyday experiences (Vygotsky,1986). Nonetheless, the marginalization and attempted erasure of the ways of knowing and understanding of racially and ethnically minoritized (REM) students in classrooms continues to be documented (King & Brown, 2014; Spring, 2016) in spite of the negative emotional and intellectual/academic (Baldwin, Duncan, & Bell, 1987; 1997; Kagan, 1990; Lewis, 2004) impact such instructional and assessment practices may have. In this paper, we seek to share our approach to develop culturally affirming tasks for students in Grades K-2 that leverage these knowledges instead of dismissing them.

Equity scholars in the field of education have long advocated for instructional practices that help to facilitate these connections between students' lived experiences and schools. For example, culturally responsive (Gay 2002, 2015), culturally relevant (Ladson-Billings, 1995a, 1995b, 2014, 2021), and culturally sustaining (Paris 2012, 2014, 2021) instructional practices have been found to be successful across multiple grade levels and content areas with respect to feelings of belongingness (Covarrubias & Fryberg, 2015; Flint & Jaggers, 2021), engagement/motivation (Borck, 2020; Kelly et al., 2019), and overall achievement in math (Romero, 2009, McCarty & Lee, 2014), science (Matthews & Smith, 1994), and reading (Cavallaro & Sembiante, 2021). We fear, however, that culturally responsive, relevant, and sustaining approaches to instruction will ultimately fail if they are not accompanied by assessment practices and tools that represent similar, asset-based approaches. Indeed, instructional practices are often informed-by (driven by)

assessments (Passinger, 2022). There have been extensive calls for the use and promotion of asset-based, culturally affirming (culturally responsive, culturally relevant, and/or culturally sustaining) approaches to formative and summative assessment (see Hood, 1998; Lee, 1998; Qualls, 1998; Randall, 2021; Randall et al., 2021; 2023a; 2023b). This paper echoes those calls drawing on the research literature in three broad areas: (1) funds of knowledge (FoK); (2) computational thinking (CT) practices; and (3) formative assessment to describe an asset-based, culturally affirming approach to assessment with K-2 students. As a research team, we set out to develop assessment tasks that would tap into Ebony's CT skills in ways that would (a) resonate with her lived experiences and (b) provide her teacher with asset-based information about Ebony's skills and abilities.

Funds of Knowledge

Moll et al. (1992) defined FoK as the "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (p. 133). The requisite knowledge/skills are shared with/through family and social connections in multifaceted and intersecting ways (e.g., the uncle who teaches carpentry, goes fishing with the father, and attends birthday celebrations). The authors note that within the context of households, teaching and learning are largely driven by the children's interests and inquiries; and children acquire knowledge themselves rather than have it imposed on them by adults. This comprehensive set of experiences, shaped by the cultural organization of the households through work, play, individually, with peers and/or with adult supervision helps form the funds of knowledge that children bring to school. Moll et al. (1992) maintain that although these FoK are often overlooked and undervalued in traditional schooling, they can be strategically incorporated into classroom instruction leading to more meaningful and effective learning experiences for students.

For example, working in a community with many Mexican and Yaqui families, Moll et al. (1992) trained ten teachers in ethnographic observations, interviews, as well as data management and analysis to have these teachers unsurface the rich funds of knowledge possessed by their students. The data based on visits to 25 households as well as 100 observations and interviews was then used by teachers to inform their instructional content and practices. The authors describe how one teacher discovered considerable student interests related to public policy/laws (e.g., student describing the differences in laws in the U.S. and Mexico) and commerce (e.g., student who loves to sell things and visits Mexico annually returning to the U.S. and selling Mexican candy to other students). She used this information to design a learning module centered around the theme of candy integrating multiple curriculum areas (math, science, health, consumer education, etc.).

Moll et al. (1992) offer the FoK framework as a powerful lens for understanding and leveraging the diverse knowledge and skills present within students' homes and communities for teaching. In our work, we wanted to explore how this FoK framework (which relies on qualitative research methods and meaningful collaboration between teachers, researchers, and families) can be further leveraged in the development of *assessment tasks* that support educators in moving beyond deficit-based perspectives by creating more engaging, relevant, and effective assessment experiences that connect students' lived experiences to assessment.

Computational Thinking

A 2010 report entitled *Running on Empty: The Failure to Teach K-12 Computer Science in the Digital Age* (Wilson et al., 2010) generated considerable concern among many stakeholders. The authors found that, despite computing being one of the fastest growing job markets at the time, the majority of middle/high schools had very few computer science standards. Of course, this finding echoed what the nation knew with respect to STEM participation broadly speaking. Scholars in computer science have argued that computational thinking provides a strong foundation for computer science (Kafai & Burke, 2014). Computational thinking can be defined as the mindset required to frame problems in a way that allows for systematic solution

development (Wing, 2011). Earlier studies have indicated that children and their families often incorporate different aspects of computational thinking into their everyday activities (Wing, 2006). For example, while children might not be familiar with terms such as algorithm or conditional reasoning, many 6- to 7-year-olds are able to outline the step-by-step process of visiting a relative or getting ready for an extracurricular activity after school. In fact, CT scholars encourage (and describe) the integration of CT, not for the sake of coding for coding's sake, but rather to create games, animations, and stories (Kafai & Burke, 2014; Brennan & Resnick, 2012).

Moreover, although the work is still quite nascent, the field of computer science (CS) has been working to incorporate the cultural practices and everyday lived experiences of families (FoK), mainly focusing on secondary education settings. For instance, Eglash and his team (Eglash, et al. 2006) aimed to develop CS design tools that resonate with the cultural backgrounds of underrepresented groups in the field. Their work has resulted in programs that simulate cultural arts, such as Native American beadwork, African American cornrow hairstyles, and urban graffiti. Aligning with findings in mathematics and science, the research by Eglash and his colleagues demonstrates how everyday knowledge can enhance academic engagement and reflect the experiences of traditionally excluded populations. Our work is intended to contribute another example of the ways in which educators can integrate culturally affirming practices into their instruction and assessment of CT. We note that CT in the early grades, including how young children engage in CT in their everyday lives, remains an underexplored area of research.

To guide our work, we relied on the Massachusetts Curriculum Framework for Digital Literacy and Computer Science to define elements/principles of CT: abstraction, algorithmic thinking, data, programming and development, and modeling and simulation. A description of each of these strands can be found in Table 1.

Formative Assessment

We acknowledge the importance, and role of, assessment use in classroom spaces - including the use of summative assessments. This work, however, was conceived in light of the need to attend to the value/importance of the use of formative assessment practices, specifically and especially within an asset-based community of learning. Unfortunately, the current accountability model has (perhaps unintentionally) led to assessment practices that promote lower cognitive levels of engagement (e.g., memorization), feel more like opportunities to reveal what students do not know rather than an opportunity to leverage what they do know, and are often attached to inappropriate purposes such as teacher evaluation fueling a culture of fear and deception (Noddings, 2012; PBS, 2015; Pabst, 2024; Strauss, 2015). We maintain that these practices have resulted in an educational culture in which the term *assessment* is viewed fearfully or an activity that must be endured or overcome. We believe that an asset-based approach to *formative assessment* can reorient teacher and student perceptions of assessment in a way that supports both teacher and student growth/development. In fact, in an extensive analysis of meta-analysis (n=800) of student outcomes and their influences, Hattie (2012) found that formative assessment was one of the most influential practices in producing positive student outcomes. Black and Wiliam (1998) argued formative assessment, when communicated and employed in the right way, can be a powerful weapon for cultivating a culture of student success.

Black and Wiliam (2008) defined formative assessment as any teacher or student activity that provides information to be used as evidence to adapt teaching to meet student needs. Similarly, Heritage (2010) described formative assessment as a "process fundamental and indigenous to the practice of teaching and learning" (p.1); and the benefits of formative assessment have been (and continue to be) long documented. These benefits extend beyond their capacity to provide the educator with immediate feedback to inform instructional decision making. Studies have also found that well planned and frequent formative assessment opportunities lead to an increase in engagement, motivation, and confidence in students (Clarke, 2008;

Weeden et al., 2002). Based on the promising outcomes of culturally affirming pedagogy and formative assessment practices, we hypothesized that asset-based formative assessment practices, employed in conjunction with asset-based instructional practices rooted in FoK, have even greater potential to improve student outcomes (both cognitive and non-cognitive) in how they authentically tap into students' thinking. Indeed, Heritage and Wylie (2026) wrote that "to be consistent with advances in the learning sciences, assessment should reflect cultural, socio-emotional dimensions of learning and development in tandem with the cognitive domain that has traditionally been given prominence" (p. 10).

Table 1. DCLS Computational Thinking Strands Across Grades

Strand	Kindergarten to Grade 2
Abstraction	List the attributes of a common object, for example, cars have a color, type (e.g., pickup, van, sedan), number of seats, etc.
Algorithms	• Define an algorithm as a sequence of defined steps. • Create a simple algorithm, individually and collaboratively, without using computers to complete a task (e.g., making a sandwich, getting ready for school, checking a book out of the library). Enact an algorithm using tangible materials (e.g., manipulatives, your body) or present the algorithm in a visual medium (e.g., storyboard).
Data	• Identify different kinds of information (e.g., text, charts, graphs, numbers, pictures, audio, video, collections of objects.) • Identify, research, and collect information on a topic, issue, problem, or question using age-appropriate digital technologies. • Individually and collaboratively, propose a solution to a problem or question based on an analysis of information. • Individually and collaboratively, create information visualizations (e.g., charts, infographics). Explain that computers can save information as data that can be stored, searched, retrieved, and deleted.
Programming and Development	• Define a computer program as a set of commands created by people to do something. • Explain that computers only follow the program's instructions. Individually or collaboratively, create a simple program using visual instructions or tools that do not require a textual programming language (e.g., "unplugged" programming activities, a block-based programming language).
Modeling and Simulation	• Describe how models represent a real-life system (e.g., globe, map, solar system, digital elevation model, weather map). Define simulation and identify the concepts illustrated by a simple simulation (e.g., growth and health, butterfly life cycle).

Since Black and Wiliam's 1998 article, scholars (Clark, 2005; Stiggins, 2006; Brookhart, 2010) have extensively investigated impactful formative assessment practices; and in our work we relied heavily on this scholarship in developing clinical interview protocols (i.e. one-on-one interview between researcher and

student in which students works through the task and answers probing questions; Ginsburg, 1997) for assessing students' computational thinking. Readers are referred to our general interview protocol and task-specific protocols provided as supplemental documents. In alignment with best practices with respect to formative assessment, we (a) relied on open-ended (no right/wrong answer) questions related to the task to prime students for each task; (b) designed tasks so that they could be easily adaptable (with respect to questions) by the interviewer on-the-fly; (c) were careful to allow students time to contemplate their responses and revise if they seemed so inclined; and (d) integrated probing questions throughout the clinical interview (Duckor, 2014).

In their 2026 book, Heritage and Wylie assert that a critical dimension of assessment evidence within a justice-oriented framework requires attention to cognitive, cultural, and socio-emotional domains. In this manuscript, we attempt to describe our efforts to address each of these domains, as they articulate them, by providing students with open-ended ways to demonstrate their knowledge and understanding (cognitive) via tasks that are perceived as relevant (socio-emotional) because they integrate their funds of knowledge/reflect their lived experiences.

Study Purposes

In this paper we describe our approach, working with families, teachers, and students in an urban school district in New England, to designing/developing culturally affirming tasks to assess K-2 students' computational thinking, leveraging their funds of knowledge. As Grover and Pea (2013) wrote "without attention to assessment, CT can have little hope of making its way successfully into any K–12 curriculum. Furthermore, to judge the effectiveness of any curriculum incorporating CT, measures that would enable educators to assess what the child has learned need to be validated" (p. 41). We describe three unplugged (non-digital) tasks including (a) the FoK each task sought to leverage; (b) the computational thinking skills the tasks intended to assess; and (c) the extent to which each task was successful based on seven criteria (interactiveness, immersiveness, adaptability, inclusivity, alignment with CT, functionality, accessibility). We highlight tasks representing different levels of effectiveness (i.e., the extent to which the task elicited the information we intended).

Our goal is to provide the reader with a rich description of what it looks like to develop assessment tasks that are asset-based and leverage the FoK that students bring with them every day into the school experience. Still, applied work does not always lead to resounding success; and researchers often fail to share these failures and unrealized outcomes. In this paper, we have opted to disrupt this limitation in the current scholarship by sharing tasks that successfully embodied our intent (i.e., tapped into both students' FoK and different levels of CT simultaneously) as well as tasks that failed to do so (or rather failed to do so completely). We believe that only by sharing our full learnings can the work move forward meaningfully.

Positionality Statements

The first author arrived at this work full of excitement and curiosity. Overhearing a conversation between colleagues about what the original research team was going to attempt (leverage young students' FoK to design assessment tasks), she invited herself in as an observer. As a Black woman in the field of assessment/measurement who understands expertly the rules, guidelines, and principles of traditional approaches to formative and summative assessment, the opportunity to completely re-envision (with like-minded colleagues) what this process could be in a way that would center the lived experiences of students who look like her has been remarkable. In this work, she positions herself as both learner and dreamer.

The second author had over the course of years applied a FoK perspective to teaching mathematics methods courses for elementary and early childhood licensure students. An FoK approach to supporting methods students, which included preservice teachers incorporating everyday aspects of children's families and communities into the math classroom, took on particular import as a White educator teaching mostly White students that often had teaching placements with mostly Black and Brown students. This project provided an opportunity to apply such an FoK perspective to research design.

The third author is a current UMass Amherst teaching faculty and works to broaden participation in Computer Science. As a brown woman that taught large introductory undergraduate programming classes, she is aware of the importance of being a role model for students that are not very well represented in computer science. An expert in computer science research methods, she has worked to expand the scope of computational thinking to primary and middle school students.

The fourth author is a current UMass Amherst Ph.D. student with a background in CS and 10 years of experience running and developing makerspaces. As a Black woman and educator, she joins the team with a commitment to the development of inclusive and diverse hands-on learning opportunities for all students. By developing assessment tasks grounded in the foundational knowledge already present among minoritized students and families, we aim to deliver a novel and lasting contribution to assessing CT with culturally affirming assessment tools.

Method

We approached our research with a design-based research (DBR) methodology that allows for the simultaneous facilitation of design and analysis. DBR approaches are particularly appropriate when conducting research within natural settings, such as classrooms as well as when designing and studying an instructional context where there is limited existing research (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Cobb & Gravemeijer, 2008; Schoenfeld, 2006) as is the case with our focus on assessing computational thinking in the early grades. Our design-based methodology included five phases described in the following text: (1) three professional development workshops for teachers; (2) data collection (family interviews); (3) data analysis; (4) task development and (5) clinical interviews.

Setting

Our focus on FoK was part of a larger Research-Practice Partnership for CSforAll in Brookland, New England which already involved approximately 75 teachers within the K-2 grade range. The public school system in Brookland predominantly consists of Hispanic students (69%), with the remaining student demographics being 18% Black, 8% White, 2% Asian, and 3% unclassified. Despite long standing and historical systems of oppression that have rendered this community as primarily low income (86%), initial observations revealed a hard-working community of families committed to each student's success. The research discussed in this manuscript represents work with teachers and students during the second and third year of the project.

Teacher Recruitment

Before beginning the study, we obtained approval from the university's Institutional Review Board (IRB). The IRB sanctioned all recruitment materials, interview protocols, and our design plan. We recruited seven teachers from Brookland Public Schools (BPS) to participate in the project. We contacted teachers from the broader RPP and others within Brookland, interviewing all interested candidates and ultimately including all applicants in the project. All participating teachers identified as White, with teaching experience ranging from 10 to over 20 years. Teachers successfully recruited 11 families to participate in the study with them. All names and locations identified in this study are pseudonyms for the sake of anonymity.

Professional Development Workshops

Our research team created a series of three workshops to provide professional development for the participating teachers. The workshops aimed to (a) introduce the participants to the Funds of Knowledge (FoK) approach and computational thinking, (b) familiarize them with the clinical interview assessment method, and (c) prepare them to conduct family interviews. The reader is referred to the supplemental materials for a more detailed description of each workshop.

Family Interviews

We created and implemented a semi-structured family interview protocol (available in supplemental materials) based on Seidman's (2006) phenomenological interview method to learn more about families and the communities where they live. Our teacher participants sought to conduct interviews with two families each. Out of the seven participating teachers, five successfully completed interviews with both families, one teacher completed interviews with one family, and the last teacher recruited two families, both of whom eventually withdrew from the study. All interviews were audio recorded.

Interview Analysis

The research team examined the family interview transcripts to identify themes related to FoK. From 11 sets of family interviews, our team reviewed transcripts to identify these FoK themes and develop a refined coding scheme. By resolving any coding discrepancies through interactive discussions, we applied the revised coding scheme and identified various themes across all the family interviews. This coding process allowed us to start identifying vignettes within the transcripts—sections that may encapsulate themes related to family and community knowledge. Both researchers and teachers participated in identifying vignettes within the transcripts. Researchers reviewed all transcripts for potential vignettes that could inform the creation of assessment tasks, while teachers initially focused on identifying vignettes in the transcripts of their own interviews. These vignettes became the centerpiece of an analysis meeting involving all researchers and teachers aimed at identifying the most promising vignettes (with respect to FoK representation and CT potential) that could lead to task development.

Assessment Task Design / Development

The main goal of the project was to create culturally affirming, or asset-based, assessment tasks for CT, rooted in family and community FoK. With vignettes selected, we initiated a comprehensive approach to develop and refine these tasks. Our task development aligned with the design-based research methodology of our project, meaning it was an ongoing and iterative process. This involved sub-groups focusing on task development and production, along with team meetings to discuss how these tasks related to both CT and FoK. As outlined in the following, we tested the tasks through clinical interviews with kindergarten to second-grade students. Based on the feedback, particularly from teachers and student responses during the interviews, we refined the tasks and interview protocols as necessary. Task development was divided among two design teams at one university which included undergraduate, master's and doctoral students (some of whom were former teachers).

Assessment Tasks

In this section, we provide a detailed description of three of the unplugged tasks developed by the research team. The overview includes the inspiration(s) for the task (via family interviews), the computational thinking standard(s) the task is intended to assess/elevate, as well as a description of the procedure for engaging with the task. All assessment tasks were initially designed to be evaluated using the eight interrelated criteria described in Table 2. As the project progressed, however, we had two important observations: (1) Our sample of students (all of whom were quite young) did not include students with diagnosed physical or learning disabilities making it difficult to evaluate the extent to which the task would be appropriate for

students with these identities; and (2) We found that much of what we might expect to be included in evaluating the accessibility of a task would also be found in evidence supporting (or not) the adaptability of the task. Consequently, accessibility was removed as a criterion by which we evaluated each task; and we focused on the remaining six criteria. In the following space we describe each of the three tasks presented in this paper: Healthcare, Library, and Movie Night. For each task we include the FoK intended to be leveraged, the CT skill targeted (also seen in Table 3), and the task administration procedure.

Table 2. Evaluative Criteria for Assessment Tasks

Criteria	Question	Types of Evidence
Inclusive / FoK Aligned	Does the task reflect the sociocultural identities and/or lived experiences of the user?	Students recognizing (verbally) aspects of the tasks (e.g., favorite books, parents' jobs, neighborhood locations)
Interactive	Does the task allow a two-way flow of information between the task and the user?	Students actively engaging with the task and speaking with/to the interviewer - answering and/or asking questions.
Adaptable	Does the task adjust for different levels of knowledge (what kinds)?	The ability to engage with the task without being a strong reader The ease in which the interviewer can make the task more/less complex based on students' initial responses
Immersive	Does the task hold the attention of the children in the targeted age span?	Students report liking the tasks Students actively engage for the duration of the task (as opposed to daydreaming, fixating on surrounding activities, or walking away)
CT Aligned	Does the task map to the CT outcomes in the DLCS curriculum for the grade?	Examples (from videos & transcripts) of the task assessing students' proficiency with data, algorithmic thinking, abstraction, programming & development, and/or modeling/simulation
Functional	Does the task support hands-on interaction with manipulatives and can be used in a physical environment?	Students moving around/working with the task components Interviewer reports of ease of transport and organizing materials for student use
Accessible	Does the task support students with special needs? What types?	Students with disabilities actively engaging with the task without feeling frustrated.

Healthcare Task

FoK. During family interviews, we found that multiple families had members in the healthcare profession in various roles. One mother, who works in a hospital, explained that her job is a very *discreet* role in the hospital: "My job is one of the jobs that…When it comes to the hospital, some people don't even know much about it." She goes on to explain that she is responsible for placing the surgical instruments in operating rooms. Another parent noted that she comes from a family of medical professionals. In her

interview, she noted that her sister and brother-in-law are pharmacists, her baby sister is pre-med in college, and that she graduated with a major in public health. The parent went on to say that she works in human/health services taking care of elderly patients and/or patients with dementia and that she loves the work. We believed that a task with health care as the focus would resonate with many students as it would (a) represent the everyday work practices of family members and/or (b) represent an everyday practice of the students themselves (e.g., getting check-ups).

Computational Thinking. This task focused on three strands of CT: algorithms, data, and modeling/simulation. To identify evidence of algorithmic thinking students were asked to recall information/steps about routine doctor's visits and verbalize a basic check-up with the use of props. To reveal evidence of data, students were expected to use context clues and their knowledge about healthcare to identify what a typical trip to the doctor would require including the identification and description of basic medical instruments. Finally, to uncover evidence of modeling/simulation, students were asked to engage in a simulation activity: walking through a check-up scenario using props. The task was intended to draw on their prior knowledge about visiting a doctor and help them apply it in a new context

Task Administration/Procedure. The interviewer began by informally discussing students' experiences or knowledge of doctor visits to build rapport. Students were shown a set of medical instruments (see Figure 1) and asked to identify them and their uses (i.e., data). Next, students verbally simulated a routine doctor's visit, indicating which instruments would be used at different stages (i.e., algorithm, modeling/simulation). After this general simulation, the interviewer introduced specific scenarios (e.g., arm injury) and asked students to reconsider which tools would be needed. Follow-up questions customized to the student's responses (e.g., Would this instrument be helpful if you had a headache?) further probed their understanding and reasoning.

Figure 1. Healthcare Task: Medical Tools/Equipment

Library Task

FoK. During family interviews, parents frequently recalled previous interactions with their local public library and/or the desire to use the library more often. In fact, we saw this theme across four families and multiple interviews within these families. For example, one mother noted "I used to go there [the library] all the time, and then I'd bring her [the daughter]. They have a little space in the back for little kids, and she used to take books." Another parent recalled her own experiences as a young person hanging out with her cousins going to the local library saying: "...And I know we used to go to the library a lot, 'cause the library in W. Brookland used to do a lot of stuff. You know how they do in the summer, libraries do stuff, or go to

the parks…" A separate parent, when referring to fun family activities, remarked "We spent so much time between the Rocktown Library and Palmerville Library when my older kids were younger. We were always there. That's a good idea. Maybe one of these times Steve's fishing at an odd hour we'll go over to the Bridgeport Library again." Ultimately, analysis of family interviews revealed that (a) Many of the kids are familiar with their local libraries; (b) Most parents are aware that the library offers programming for kids, including story times and reading spaces; and (c) There's a desire from many parents to expand the use of the library.

Computational Thinking. We found the library theme to be compelling both as FoK (everyday experiences students experience with families). For this task, a decision was made to focus on abstraction and data. To reveal evidence of abstraction, the task would require students to determine the qualities, or attributes, of a series of book covers (e.g., what are the *main* images, what are the *important* parts of the book cover). To uncover evidence of data, students were asked to identify different kinds of information (e.g., pictures on the cover) and also propose a solution to a question based on analysis of information (e.g., "I have forgotten the name of this book; how would I describe it to the librarian if I wanted to read it?").

Task Administration/Procedure. To select books for the library task, the research team gathered titles from classroom lists, online sources for popular early-grade books, and recommendations from families and friends, ensuring a diverse and familiar selection. Book covers—including titles like *The Bad Seed*, *The Very Hungry Caterpillar*, and others—were printed, laminated, and prepared with two sides: the original cover and a version with the title blocked out (see Figure 2). During interviews, students discussed their interests, library experiences, and favorite books. To assess computational thinking, students described how they would search for a book on a chosen topic, then viewed a cover with its title redacted and inferred what the book might be about. The interviewer then asked students to evaluate which search terms fit a particular cover (e.g., suggesting words for a winter scene) and justify their reasoning.

Figure 2. Library Task: Examples of Book Covers

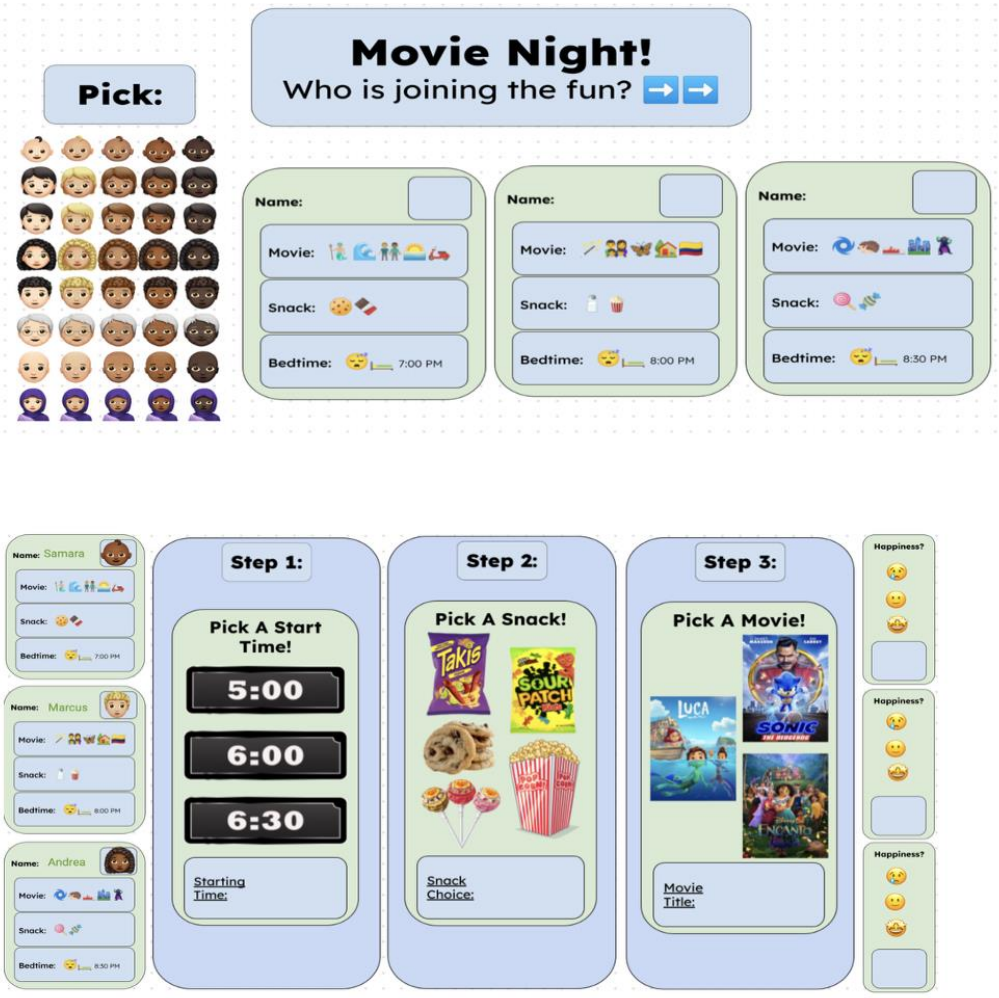
Movie Night Task

FoK. During one family interview, the family tradition of movie night was discussed. Referring to Movie Night, a parent noted: "…We used to have like a movie night, with her, … we usually have our little popcorn, and I'll take him to the gas station and we pick out candies and snacks…" Indeed, the concept of at home movie nights or trips to the theater is one that resonates with/is familiar to many students and families. This practice can also be as simple as a family enjoying their favorite television program together. Consequently, we thought it was a worthwhile practice to leverage in designing a task.

Computational Thinking. With what we learned from participating families about movie night traditions, the development team decided to leverage this everyday experience to assess students' proficiency with data: individually and collaboratively, propose a solution to a problem or question based on an analysis of information. Given that a family movie night typically involves making a collective choice to watch one movie or program, the Movie Night Task was designed to tap into students' FoK around family or group membership and the calculated ways in which members often need to balance a number of different preferences and needs in designing optimal experiences of shared quality time together.

Task Administration/Procedure. Students planned a family movie night by selecting family members (up to six), assigning avatars or name cards, and recording each person's preferences for movies, snacks, and bedtime (using emojis or brief descriptions as appropriate for grade level; see Figure 3). Students identified

Figure 3. Movie Night



each participant's preferences and discussed them with the interviewer. They then determined and sequenced three steps for movie night—choosing the movie, snacks, and scheduling the time—placing cards in labeled spaces for each step. Students were asked to explain their reasoning for the order chosen. Next, students used the collected data on family preferences to make choices for each step, justifying their decisions and checking alignment with family needs. Choices included several movie options (e.g., *Luca*, *Encanto*), snacks (e.g., Takis, popcorn), and bedtimes. Finally, students evaluated their plan by assigning happiness emojis to each family member and reflecting on how well their choices satisfied everyone. Interviewers prompted discussion about compromises and optimal decision-making.

Table 3. Assessment Task x Target CT Strand(s)

CT	Healthcare	Library	Movie Night
Data	✓	✓	✓
Algorithms	✓		
Abstraction	✓		
Modeling & Simulation		✓	

Results

In the following text we present the results from the clinical interviews highlighting specific interactions that represent the extent to which each of the three tasks met our evaluative criteria (alignment with FoK, interactiveness, immersiveness, adaptability, inclusivity, alignment with CT, functionality). We begin with an example that met all of our evaluative criteria for success: The Healthcare Task. The Healthcare Task leveraged students' everyday experiences (in that students were familiar with trips to the doctor and/or had family members who worked in healthcare); and allowed students to demonstrate their CT skills (and the research team to better understand how these CT skills varied across students).

We follow our discussion below of the successful task with the findings from the Library Task. Although the Library Task did a nice job of incorporating an everyday family practice (i.e., going to the library), the research team felt that the book selections employed in the task did not adequately represent the identities or experiences of the students. Nonetheless, the task did afford students the opportunity to demonstrate their CT. Consequently, we view the task as partially successful. We share the findings of the Movie Night Task last as it represents one of our least successful tasks. Despite our initial confidence in the task's suitability, it proved to be unwieldy with respect to implementation (too many materials), lacking in its ability to reveal/uncover students' CT processes, and required too much prior knowledge to engage with it.

Healthcare Task

The Healthcare Task targeted CT concepts of algorithmic thinking, data, and simulation in a game in which students played with a toy medical kit to describe a visit to the doctor. Four first grade students participated in clinical interviews working through the Healthcare Task. Interviews with students lasted approximately 10 to 14 minutes across the four students. In each case, we found evidence of various levels of data, modeling/simulation, and algorithmic thinking. For example, with respect to data, one student, Miles, was able to identify most of the tools either by name or function. He understood that the blood pressure cuff needed to be wrapped around his arm and that the reflex hammer was used to check reflexes

in the knee (he simulated these actions). He also recognized and understood the purpose of the stethoscope, syringe and other tools. And these findings were consistent across all students. Interestingly, we found the most variability in how students articulated the use/purpose of the scissors found in the medical kit. Initially the student could not identify a use for the scissors, but towards the end of the interaction, he remarked that scissors could be used to cut a Band-Aid that is too big. Another student, Irene, proposed that the scissors be used to cut thread when used to apply stitches (she recalls this from when her brother was bitten by a dog and needed stitches). And, another student, Kameron, articulated that the scissors were used for cutting out a piece of your hair if something gets stuck in it. Finally, our fourth interviewee noted that the scissors were used for cutting stuff that is hard to open. As a research team we noted that all of the purposes articulated by students were legitimate and made sense in the context of any visit to the doctor.

Evidence of algorithmic thinking was more difficult to parse out across participants. For example, one student relied heavily on her prior experience visiting the doctor and laid out a definitive order. When the interviewer suggested changing the order, she adamantly held to her original ordering. The conversation that followed (refer to Student 1 in Supplemental Table 1 for transcript) revealed the student had a very clear (and non-negotiable) understanding of the series of steps, or algorithmic thinking, required during a visit to the doctor's office. And, even when the interviewer suggested that another sequence might be equally correct, the student insisted on adherence to the order she articulated.

Other students, however, were less insistent in their choices. For example, one student was able to recall visits to the doctor indicating that he goes so that the doctor can "see if I feel healthy." Although the student laid out a sequence of actions for a typical doctor's visit, his choices seemed less deliberate with respect to order as he seemed to select medical instruments as he remembered them (not necessarily in the order that they are typically, or should logically be, used). Moreover, the student was far more willing to allow the interviewer to switch his original order (see Supplemental Table 1, Student 2 for full vignette). Still, this student's apparent flexibility with respect to sequencing could also reflect an underlying fundamental understanding that the order of many of these steps is, in fact, inconsequential; and perhaps one should simply do them in the order that they remember (so they do not forget).

A third student, however, was better able to justify his choices with respect to the order in which the medical instruments would be used/needed. This reasoning was best displayed when the interviewer began suggesting an alternative order for some of his decisions (refer to Supplemental Table 1, Student 3 for full transcript). The student demonstrated a fundamental understanding of why certain processes at the doctor's office happen in the order he articulated. For example, he understood that failure to place a bandage on a patient's arm immediately after an injection might result in cumbersome bleeding, so the interviewer's suggestion to wait until the end to place the bandage was an inappropriate choice. Moreover, he understood that one needs to have their temperature taken early in the process to ascertain if they are sick; and waiting leaves the doctor in the position of not knowing if the patient is sick or not (and how to proceed).

Evaluation. We found ample evidence of the task's interactive, immersive, and functional nature. The task called for students to discuss their personal experiences going to the doctor, which often led into storytelling about their lives (e.g., allergies, brother getting stitches, etc.) which helped to hold each student's attention throughout the entirety of the interview. Moreover, using toy medical tools gave the students physical objects that they could manipulate. This task was designed with adaptability in mind and, we believe, successfully so. The task was relatively easy for the interviewer to adapt based on students' experiences. For example, if a student was unfamiliar with a particular tool, that tool could simply be removed and not included as part of the task. Because the task required students to reflect on their own experiences (either personal or of family members), we believe we met our criteria for inclusivity. Ultimately, as a team we were unable to determine every time (based on data from just one clinical interview) if some students were (a) recalling the order of how things happened for them at the doctors; (b) thinking about what order just made

the most sense for them; and/or (c) just ordering the steps as they recalled them. Still, we saw some clear evidence of algorithmic thinking and reasoning (e.g., understanding the shot must come before the bandaid) in some students and evidence of data in all students.

Application for Teachers in CT and CS Instruction. In reviewing clinical interview videos/data, we also sought to understand how this information could/would inform teachers' instructional decisions as they sought to teach computer science (recall that this project is a part of a larger Research Project Partnership, Computer Science for All) concepts to these young students. We believe that we saw sufficient evidence that all the students had the capacity to recognize individual commands of code (e.g., _____ *means* _____) and ascribe meaning to the commands (i.e., data). Although we are unsure with respect to the student who seemed to believe that the steps in a doctor's visit are completely interchangeable, we also found compelling evidence that multiple students were ready to engage in (and understand) CS lessons involving sequencing in programming. Healthcare revealed a variety of ways in which young children think algorithmically, critical information for a teacher seeking to design CT instruction for her classroom in ways that meet students where they are at. Just as students were able to articulate the steps in which one would complete a doctor's visit (e.g., check temperature before giving a shot), students would be able to grasp the concept that one must tell the program to _____ before it can be told to _____. And in these cases, we also saw evidence that students were ready to engage in discussions about which commands could (and could not) be interchanged.

Library Task

The Library Task targeted CT concepts of abstraction and data in a game in which students were asked to consider descriptors, reflecting potential search terms, to find a particular book. Three first grade students participated in clinical interviews working through the Library Task. Interviews with students lasted approximately 11 to 18 minutes across the three students. Across all three students we saw evidence of various levels of CT (data and abstraction, specifically).

For example, one student, while looking at the cover of *Snowy Treasure*, found it quite easy to generate examples of search terms that might help the librarian identify the book (e.g., winter, snow). In fact, based on these explicit visuals (e.g., a candy cane, gingerbread, snow), the student reasonably abstracted that the search terms holiday and Christmas could be used. When the interviewer began the process of suggesting additional search terms (to evaluate the limits of the students' reasoning) and suggested the term sleigh (a term intended by the interviewer to represent a reasonable description of the cover), the student curiously responded no. The interviewer probed again asking "Do you think that's a sleigh? Doggie sleigh?" (pointing to the presumed sleigh); and the student reiterated her negative response. When asked what she thought it was, she explained that it was towing things and he (the snowman) was standing on it. She then further explained to the interviewer that "A sleigh is like a car, but it flies in the sky." This interaction with this student demonstrates an important consideration when attempting to employ asset-based approaches to assessing students' ways of knowing and understanding. To the [adult] interviewer, the 'vehicle' was obviously a sleigh; and had the interviewer been administering a typical assessment (whether selected response or short answer), acknowledgement of the sleigh would have been the only correct answer. In this case, however, with additional probing it became clear to the interviewer that the student had assigned certain attributes to sleighs (i.e., abstraction) and that the vehicle on the book cover did not meet those requirements (i.e., it was not flying in the sky). Thus, the interviewer responded "*Oh. Thank you for that correction. Forgetting my good sense*" and moved forward with additional possible search terms.

In the same clinical interview, the student was shown the cover of *If You Give a Mouse a Cookie* and asked for appropriate search terms. The student used words such as mouse and cookie, all of which were appropriate. When probed by the interviewer with the question: "Now, if you told the librarian, 'I want the book that has white on it with some green,' would she be able to help you find that book." The student

indicated that those search terms would not make sense because the terms "green" and "white" don't "count as the story." The exchange illustrated the student's ability to identify the qualities/attributes of the book cover that provide meaningful information versus those pieces of information that are tangential, or virtually meaningless, for the task (in this case getting the librarian to understand what she needs).

An interaction with another student, Tatiana, revealed similar benefits to an asset-based approach to investigating students' CT skills. First, an exchange between the interviewer and student related to the words magical v. magic, highlights a potential benefit of engaging in asset-based assessment approaches that center students (see Supplemental Table 2, Tatiana). The interviewer initially misheard the student [twice] and misidentified her search term as magical. The student, however, corrected the interviewer to make clear that the term she wished to use was magic. Although the interviewer could not immediately recognize the important distinction between these two terms, it was clear that this student assigned particular attributes to magic and another set of attributes to the term magical; and that these search terms could not, in fact, be used interchangeably. Moreover, and more importantly, the student felt comfortable asserting her position confirming that asset-based approaches to assessment have the potential to be affirming.

Another important observation emerged from this clinical interview. Similar to the *sleigh* interaction with the first student, the interviewer suggested what she thought would be an obvious search term for someone looking for the book *Sleeping Beauty* - the term princesses. Nonetheless, the student insisted that the use of this term was not at all appropriate. Upon reviewing the video data closely, the research team realized that the student's reasoning was, in fact, quite reasonable. The team recognized that if one is looking for a book about princesses (and is standing in the princess aisle of the library), using the search term princess would be redundant and not help to pare down the list of possibilities. In this case, eventually the team would come to see the task from the perspective of the student who was solving the problem based on how she saw the world (e.g., why say princess in the princess section?). Within this perspective, it became clear to the research team that princess was not a helpful search term, but magic, beautiful, and love were solid search terms.

In general, we found that students were able to identify appropriate search terms with relative ease. For example, one student, Charlie (see supplemental Table 2 for full vignette) was able to do so even when presented with a book that was unfamiliar to him (*Snow Bear*). He indicated the illustration of snow, trees, ice, etc. all suggested that it was a book about animals in the winter. Charlie also noted that terms such as *thunder* would not be appropriate (though *snowstorm* would).

Evaluation. We found ample evidence of the task's interactive and immersive nature. The task called for students to discuss their own favorite books and favorite topics; and it required active conversation between the interviewer and student. Moreover, they were given the option to choose the book covers that resonated most with them. We also found the task to be quite adaptable. For example, it allowed for the interviewer to write down the search terms as the student provided them (for students who may struggle with writing or writing quickly) or the student could choose to do so. We also found the task to be functional - the use of laminated book covers made the task far easier to administer than (perhaps) the use of actual books. With respect to inclusivity, we maintain that the task has the potential to relatively easily integrate the sociocultural identities of the students. Nonetheless, in this case, the books we selected did not, in fact, reflect the identities of the students we interviewed. Our findings suggest that while connecting tasks to familiar community resources like libraries can facilitate students' demonstration of abstraction and data skills, the representational content of assessment materials must also reflect students' identities to fully realize culturally affirming assessment practices. Thus, both context and representation are critical components in equitable assessment design.

Application for Teachers in CT and CS Instruction. Like the Healthcare task, the Library task was a good source of information with respect to what students were ready to learn (e.g., commands, or more advanced coding). For example, it provides insight into which students might be well-prepared to

independently troubleshoot or employ reasonable search terms when coding/programming (e.g., I want my avatar to do ____, so I should search the manual for terms like ___). We also saw ample evidence that students were capable of identifying what information is important (e.g., a mouse) and information that was not (e.g., green) suggesting they are ready to begin thinking about parsimony. Perhaps more importantly this task is an example of an assessment that is most helpful in helping teachers better understand (and embrace) the notion of REM students having many varied ways of knowing and understanding. It illuminates how students use the contextual clues around them to make decisions and omit unnecessary or redundant information like when a student said that white and green would not be good search terms for "*If You Gave a Mouse a Cookie",* because "it doesn't count as the story." We believe this particular task would serve as a good example in assessment courses dedicated to helping pre-service and in-service teachers committed to engaging in culturally affirming and asset-based approaches to their instruction and assessment.

Movie Night

In this section, we present findings from our last task: Movie Night. Movie Night targeted CT concept of data in a game in which students were asked to help plan a movie night involving their families. Initially, the research team saw promise with the movie night task. Having students propose solutions to a problem (e.g., family members/loved ones having different conflicting preferences) resonated with the team as a task that would tap into students' everyday household experiences as well as their computational thinking. This task, however, proved to be one of our least successful during implementation. Nonetheless, we share this task with intention for the reader. We believe that it is important to understand not only what has worked, but also what has failed when engaging in meaningful attempts to tap into the cultural resources and lived experiences of REM students. Because the task's limitations were revealed so clearly with the initial clinical interview, and our goal was to support and leverage student learning (and not merely collect as much data as possible), we conducted only one (20 minute) clinical interview with a second-grade student. In the following paragraph we describe the task's strengths and limitations.

With respect to FoK the task performed adequately. This student did, in fact, have experience with movie nights (i.e., tapped directly into her lived experience; and it allowed the student to select which family members/loved ones would experience movie night with her (and she was allowed to select the avatar that best represented each person. For example, she decided to choose an avatar for her brother "because he has black hair."

Still, the task failed to meet expectations with respect to establishing a set of circumstances that would reveal computational thinking for several reasons. First, the task required an extensive "set up conversation/activities" (nearly 8 minutes) describing emojis, different movie choices, snacks etc. These friendly yet unfamiliar materials necessitated extended exploration to familiarize the student with them at the front end of the interview. Given our goal was to keep each task no longer than 15 minutes, expending half of that time setting up the task suggests it was simply not appropriate for this age group. In fact, the research team noticed the student become increasingly fidgety around the 15-minute mark of the video recording. Extensive materials became unwieldy to organize in a fluid and accessible way as the task unfolded, which created pauses that felt disruptive to the flow of the assessment task. Exacerbating this, this student (and we imagine any student) was not familiar with all of the snacks or movies presented, thereby shifting the discussion away from CT ideas in order to talk about specific snacks or movies. Lastly, we anticipated that in this game any family member would not have all desires met, leading us to introduce emojis featuring emotions; we found this student very reasonably wanted everyone to be happy and assigned a happy emoji to each family member, once again shifting the focus away from CT ideas.

Moreover, we realized that students at such a young age do not, necessarily, understand specific times such as 7:30 pm or 8:30pm, particularly in order to consider when to start a movie in order to get to bed for that bedtime, rather they rely on time descriptions such as bedtime, dinner time, etc. Students in general may

also have a parent at home that will indicate when an event like bedtime is starting or about to start, making it less likely that students themselves come to attend to the precise time of day. In addition, the duration of the movie was also an inaccessible concept. Finally, the task itself was simply too cumbersome for the interviewer involving too many moving pieces to keep track of and share with the student. Still, the student remarked that the task was *fun*. The challenges encountered with the Movie Night task highlight the need for assessment designs to account for developmental appropriateness and the complexity of task materials. While relevance to family routines is important, tasks must be structured to elicit targeted thinking skills without overwhelming students. This case further supports the argument that asset-based assessment must balance cultural authenticity with age-appropriate task demands.

In summary, the three tasks present in Table 4, we provide the reader with an overview of the extent to which each task met the research team's criteria for success. While the Healthcare and Library tasks performed well across most domains, the Movie Night task struggled due to challenges with adaptability and complexity for this targeted age group.

Table 4. Assessment Tasks x Intended Criteria

Criteria	Library	Health Care	Movie Night
FoK Aligned	✓-	✓+	✓
CT Aligned	✓	✓+	
Interactive	✓	✓	✓
Immersive	✓	✓	✓
Adaptable	✓	✓	
Functional	✓	✓	

Note. A check mark indicates that the task met the criterion. A check mark + indicates that the task exceeded our expectations with respect to the criteria. A check mark - indicates that the task met the criterion, minimally so.

Discussion

The current study aimed to develop culturally affirming assessment tasks to evaluate computational thinking (CT) in K-2 students by leveraging their funds of knowledge (FoK). We worked with teachers, students, and families in an urban New England school district to design unplugged tasks that aligned with CT strands: abstraction, algorithms, data, and modeling/simulation. CT refers to ways of thinking to solve problems in everyday life, and we believe that all children engage in it. A goal of our study was to bridge those everyday practices for students in this community with assessment task design that could potentially showcase those ways in which they already think. Our findings emphasize two significant outcomes in direct alignment with the FoK framework (Moll et al., 1992), culturally responsive pedagogy (Gay, 2002, 2015), and sociocultural learning theory (Vygotsky, 1986): (1) the experiences and daily practices of students and their families offer valuable context and inspiration for culturally affirming assessment tasks consistent with Flint and Jaggers (2021) to leverage daily routines for academic engagement; and (2) challenging deficit narratives (King & Brown, 2014; Baldwin, Duncan, & Bell, 1987), our study provides strong evidences that students from marginalized groups, students actively use and apply computational thinking in diverse ways

at school and home every day – a finding that resonates with Wing's (2011) assertion that CT is a mindset transferable across contexts.

This study's strength lies in applying a design-based research methodology, permitting iterative task development and real-time feedback integration. Our iterative, design-based approach aligns with recommendations from Cobb et al. (2003) and Schoenfield (2006) for real-time adaption and feedback, which proved crucial in refining both task and content structure. The collaboration with educators and families enhanced the authenticity and applicability of our assessment tasks, embedding them with contexts directly relatable to students. We found that the tasks need not reflect lived experiences that are legendary or groundbreaking in scope. Indeed, the tasks can be compelling if they feel recognizable to students as experiences that reflect typical lives with their families and communities. Over time, these instances (of incorporating everyday experiences) accumulate for students leaving them feeling affirmed consistently and daily (and not just around the time of a major cultural holiday).

Across the three assessment tasks presented in this paper, several patterns emerged regarding student engagement, relevance, and demonstration of CT skills. First, tasks that tapped into more routine, simple family practices (e.g., healthcare visits and library visits) proved more immersive and interactive, whereas more complex activities and materials (e.g., movie night) encountered greater barriers to engagement as a result of fatigue. Second, we observed that students consistently leveraged contextual clues from their lived experience to make sense of the problem regardless of the CT strand targeted, suggesting that grounding tasks in familiar sociocultural context is critical for engagement and authentic demonstration of thinking. Finally, adaptability on the part of the interviewer (e.g., adjusting the order or materials to suit the student) was essential for inclusivity, particular when students' prior knowledge diverged from task expectations.

Challenges

The study, however, was not without challenges that warrant consideration and discussion. For example, the iterative nature of the work (indeed, a study strength) made it time/resource intensive. Family interviews (hours for each teacher), data analysis (for both the teachers and university researchers), task development/revision (university researchers and students), and clinical interviews required a great deal of commitment from all stakeholders involved. In our case this limitation was mitigated completely by grant funding. Moreover, our university affiliation enabled us to use course credit as compensation for task developers, which is a compensation model not available/accessible to most educators. We understand most teachers do not have a team of researchers working with/for them to aid in data collection, data analysis, and task development. Nevertheless, we share these findings as a promising example for moving from family interviews to task development for educators working in communities with (a) engaged parent groups, (b) aspiring or preservice teachers in need of practical experience; and/or (c) access to different funding sources.

An additional challenge that we struggled with throughout the work was moving past superficial symbols of culture/diversity. We found that teachers and parents often focused on discussions around food and holidays. While food and holiday celebrations are important, it is also valuable to explore and leverage daily routines that families engage in regularly. In our work together we had to resist the urge to create tasks that focused on grand cultural celebrations and extraordinary events. Honoring the everyday lived experiences - those experiences required for everyday living and well-being - was a focus that had to be reiterated to task design teams throughout the project.

An obvious challenge (given one of the primary purposes of this manuscript), related to the iterative design and time intensiveness, was practical execution. In some cases, even after drawing ideas directly from family interviews, iterating with design teams to develop tasks, and extensive conversations across team members about the appropriateness of the task, we still failed to produce a task to meet our goals. In this paper, we describe one task that partially met our criteria (i.e., Library Task) and another that failed to meet

most of our criteria (i.e., Movie Task). These were not the only tasks, however, that failed to live up to expectations despite the hours of labor placed into their development. Of course, this project represents our first attempt to leverage FoK to develop assessments of CT (and we are unaware of any other efforts), so we anticipated, and were comfortable with, task failures. We also expect that as the assessment community becomes more comfortable with these kinds of asset-based processes, our success rates will increase considerably.

Implications for Practice and Future Research

Our project responds directly to calls from equity-focused scholars who emphasize the need to center the lived experiences and FoK of students from racially and ethnically minoritized backgrounds in both instruction and assessment (Moll et al., 1992; Gay, 2002; Flint & Jaggers, 2021). The findings presented here highlight how asset-based and culturally affirming assessment approaches, rooted in the everyday practices of REM students, can support more authentic evaluations of student learning and CT competencies, reaffirming the importance of connecting formal classroom content to the realities of students' lives (Vygotsky, 1986; Wing, 2011).

Our work is unique in that our paper provides practitioners with multiple examples of our attempts to leverage FoK to assess students CT from an asset-based lens. Each task, however, was implemented with varying levels of success; and we discuss the limitations and strengths of each while charting a way forward for future design and development efforts. Employing a culturally affirming approach to assessment design might feel overwhelming (with infinite and amorphous starting points) to many teachers and assessment developers. This paper provides equity-oriented stakeholders with a concrete process as we move towards instructional and assessment practices that seek to sustain the rich sociocultural identities of all students. Going forward, a broader scope of diverse experiences should be incorporated to ensure the tasks' relevance across varied student demographics, particularly students with special needs. As a team we also discussed the possible benefits of conducting clinical interviews with small groups of students (as opposed to one-on-one). We suspect we would have found even more interesting information (e.g., how do students negotiate and reconcile direct challenges form peers to their own CT or leverage the shared FoK communicated by their peers) as students collaboratively worked through tasks.

Conclusions

Through iterative analysis and task development, several emergent principles from culturally affirming assessment design with K-2 students became apparent: (1) Collaborating with families and teachers throughout design and analysis ensures authenticity and relevance; (2) Assessment materials should reflect students' social and cultural identities as evidenced by their FoK; (3) Interviewers must prioritize adaptability to student responses and backgrounds; and (4) open-ended formats facilitate the capture of authentic CT while avoiding deficit-based framings. These principles align with prior calls for asset-based and responsive practices (Hood,1998; Lee,1998; Qualls, 1998) and extend them into the domain of early childhood CT assessment.

In conclusion, our findings provide a compelling case for culturally affirming assessment practices that recognize and affirm students' daily experiences. By aligning assessments with students' rich cultural contexts, educators can better support equitable educational outcomes, fostering a learning environment where all students' knowledge and voices are valued. As the field looks to 'what's next,' our study offers a concrete illustration of both promise and complexity, reinforcing the assertation of Paris and Alim (2014) that sustaining and affirming students' cultural wealth and everyday knowledge must remain central to instructional practices (and we argue, by extension, assessment practices).

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Supplemental Files

Professional Development Workshops Description

Workshop 1

The first workshop in April 2022 was designed to help teachers understand FoK. Teachers were shown videos demonstrating families engaging in everyday activities, such as making sandwiches for school and planting herbs in a garden. Although the selected online videos were not originally created to illustrate computational thinking, they still served as a useful tool in helping teachers understand how to identify FoK and link them to computational thinking concepts. During the workshop, teachers also reflected on their own lives, examining routines and experiences unique to them.

Workshop 2

The second workshop, held in May 2022, focused on training teachers to conduct family interviews. Using a case study, we worked with teachers to help them understand/recognize what deficit-based perspectives can look like - explaining how our study sought to disrupt this perspective. We also shared examples from our pilot data of how FoK were used to design prior assessment tasks. In addition, teachers were given the opportunity to brainstorm potential questions for the family interviews to uncover FoK, and we used their suggestions to enhance our interview protocol.

Workshop 3

The third workshop in May 2022 focused on the logistical aspects of conducting the family interviews which included recruiting families, collecting data, and other related processes. Teachers had the chance to brainstorm additional interview questions, evaluate the existing interview protocols. It was during the third interview that teachers were given the opportunity to engage in role-playing exercises to practice conducting interviews with each other.

Family Interviews – Protocol

This document outlines a three-part family interview protocol. The purpose of this protocol is to gather information from the participants about family and community practices that connect with one or more concepts of computational thinking. This is a semi-structured interview and the questions serve as a guideline. The researcher does not have to ask all the questions or follow a specific order; however, highlighted questions should be asked in each interview. If the participants consent, the session should be audio recorded and the interviewer will also take notes whenever possible.

Allow the interview to flow naturally and look for opportunities to ask follow-up questions when interesting topics arise. Follow up questions to use during the interview include:

- Elaborating: "Please tell me more about XXX"
- Specifying: "Please give me an example of XXX"
- Interpreting: "What do you mean?" OR "Tell me if this is what you mean…."
- Reflective summary: "What I hear you saying is …."

Interview 1: Life History (60 minutes)

Interview Focus: Guardians' own life trajectory and important life experiences. Participants for this interview include only the primary guardian(s) of the child.

Questions:

- Could you tell me about yourself?
  - Family info: number of siblings, parents, children etc.
- Where did you grow up? Can you tell me a little bit about what that was like?
  - What language did you speak in the home growing up? What language/s do you speak at home now?
    - How did you learn the languages you speak?
    - Are you teaching these languages to your child(ren)?
  - Were there any traditions or holidays that were important to you and your family growing up?
    - What was your favorite part about _____? <Or, is there any particular memory about _____ that sticks out to you? Can you say more about that?>
  - What did your birth family do for fun?
    - Could you say more about ___?
  - What did you like to do when you were younger?
- How long have you been living in Springfield?
  - <if applicable> Can you tell me about what brought you to Springfield?
- Could you tell me about your school/education experiences?
  - Where did you go to school?
  - What was important or interesting about your school experience?
- Could you tell me about your job/career?
  - How long have you been in your current job/career?
  - How did you choose your job/career?
  - Possible follow-up questions:
    - What are you most proud of about your work?
    - Was this always the career you wanted?
    - How much does your daughter/son know/understand about your work?
    - How much did you know/understand about your parents' work?
- Food/Cooking questions:
  - Is there a meal/food you grew up eating that you now share with your family?

Interview 2: Community Network (60 Minutes)

Interview Focus: Family connections throughout the community, including specific family activities that occur on a community level. Participants include the primary guardian(s) and the child.

Note: Start by building on rapport from the last interview. Last time, we talked about ___ Today, I would like to learn more about ____

Questions:

- What do you like to do together as a family?
- Besides school and home, what places do you and your family regularly go to in your neighborhood/community? What do you do there?
  - <*choose an example*> Can you tell me about what you did when you most recently <*went to the library*>
  - Do you all have a favorite park?
  - Do you all have a favorite place to eat out?
- Can you tell me about any holidays you celebrate as a family?
  - <*if applicable, ask child(ren)*> What is your favorite holiday? Tell me more about (*holiday*). Why is it your favorite? What do you do?
  - Can you tell me about the most recent time you celebrated <*holiday*>?
- Do you like to travel outside of Springfield? <if yes> What are some of the things you like to do?
- Can you tell me about any other family traditions you have?
  - What do you usually do for _____?
  - Is there something that you typically do first when you and your family _____?
- What is a typical weekend like for your family?
- Are the children (or anyone in the family) involved in any sports?
  - What sports
  - <if applicable follow up with children> So you play ____ sport. What do you like about it? Where/when/with who do you play?
- In your neighborhood, do you talk with your neighbors?
  - <if applicable> in the complex, outside the complex? What do you usually talk about?
  - Do you ever do anything with your neighbors? What kind of things?

Interview 3: Family Life(60 minutes)

Interview Focus: Activities of daily living within the home. Participants include the primary guardian(s) and the child.

Questions:

- What do you do while the kids are at school?
  - Are you able to be at home at night?
- What is a typical weekday like?
  - What do you do after school or after work once you're home?
- What is a typical weekend like?
- Who usually does the cooking in the family? Is there a meal/food that you grew up eating that you make for your children?
- Can you tell me about your morning routine before school?

Culture Questions:

- What is one thing about your culture that you would like to see emphasized/taught/understood in your child's school?
- If you could pick one thing (or 3 things) that you think are important for your child's teacher to know about your family and your family's history, what would those things be?

Questions for Children:

- What is your favorite part about school today? <Can you tell me more about __?>
  - Are there other things you like about school?

- What did you do during recess today?
  - If you had more time to play during recess, what kind of things would you like to do?
- Who are some of your friends? <*name friends*>
  - What's your favorite thing to do with <*names*>?. Tell me about how you _____ with <*names*>
- What do you like to do when you are not at school?
  - What did you do yesterday after school? OR What will you do today when you get home?
- What is your favorite game?

Tech Questions:

- Can you tell me about how you use devices, such as computers/smartphones/tablets, at home?
  - What type of technology? What do you use it for?
  - Do you share <tablet/technology> with other people in your family? How do you know who gets to use it and when?
- How often do the child(ren) use technology?
  - What type? What do they use it for?
  - <Follow up with child(ren), if applicable> So you sometimes use (a tablet)? Can you tell me what you usually do with it?
    - Sounds awesome, can you tell me more?
    - <if applicable> Can you draw a picture of _____? (tablet, game, etc. Base this on answers to previous questions)
- What technological device do you, personally, use most often?
  - What does the family use most often?

Supplemental Table 1. Transcript Excerpts for Health Care Task

Student 1	Interviewer: So we're going to start a game. We're going to play doctor and I'm going to be the patient and you are going to be the doctor. Student: Okay. Interviewer: So I come in to see you. What's the first thing you do? Student: I check your weight. Interviewer: You check my weight. Okay. Nothing on here to check your weight. We have to get a scale next time. And then after you check my weight, what do you do? Student: I do this. [holding the blood pressure cuff] Interviewer: You check my blood pressure. Student: Yeah. Interviewer: Okay. All right. Excellent. Well, you can just set it there so we can keep it in order so we know exactly what order everything is going. So you check my blood pressure, and then after you check my blood pressure…[Student picks up syringe] You give me a shot? Student: Mm-hmm. Interviewer: Okay. Student: Mm-hmm. Yeah. Interviewer: Immunization. And then after my shot, what do you do? Student: I will do this. [Student picks up tongue depressor] Interviewer: Put that under my tongue? Student: Yes. Interviewer: Okay. Student: Like this. Interviewer: And then? Student: This. [Student picks up thermometer] Interviewer: What's that? Student: I check temperature. Interviewer: You check my temperature. Okay. And then what? Student: And then we check your heartbeat. [Student selects stethoscope] Interviewer: That's important. You check my heart. Student: And then do this. [Student selects reflex hammer and pantomimes use] Interviewer: That's the, slap my knee? Student: Yeah. Interviewer: Make sure I have good reflexes? Okay. Student: And then I have to check your ear just in case you have an ear infection. Interviewer: Yes. You have to check and make sure I don't have an ear infection. Okay. So, you check my blood pressure, give me my shot, my immunization, check under my tongue. Student: Mm-hmm. Interviewer: My temperature. You check my heart. Make sure I have good reflexes. And then you look in my ear. Student: Mm-hmm. Interviewer: Okay. All right. So you decided to do all of that in that order. Now tell me, what if I said, "Change it this way."? Would that be okay? [swaps the placement of the syringe and the stethoscope, so that it is BPcuff stethoscope, tongue depressor, thermometer…] Student: Mm-hmm. Interviewer: Yeah? Student: Mm-hmm. No No No. Interviewer: No? You don't like it in that order? Student: No. I like it like this. Interviewer: That way? So you want to check my blood pressure first, then give me my shot? Student: Yeah. Then this. Interviewer: Then this? Student Then this. There. This, then this, then this. Interviewer: Then this? Okay. Tell me why that order is important? Student: Because I went to the doctor before that did that. Interviewer: And that's the order that your doctor did it in so that's the right order to do it in? Student Mm-hmm.

Student 2	Interviewer: Okay. Okay. So, let me ask you a question. If I came into your office and you said you would first check my blood pressure, then look at my ears, then check my heart. Could you do this? [Interviewer changes order of tools] Student: Yes. Interviewer: Could you do it in that order? Yeah? Why? Student: Because you would have to check this second so you don't forget it. Interviewer: Okay. So I won't forget it. Yes. And could I do this first? Student: Yes. Interviewer: Yeah. Okay.
Student 3	Interviewer: That's it. Okay. So, to recap, you'd check his temperature first, see if he's sick. Give him a shot. Use this Band-Aid on the shot. Give him his medicine. Check his heart, and then check his blood pressure. Student: Mm-hmm. Interviewer: Let's see. Could I do this? Swap those two things. Check his blood pressure, then his heart, then give him the medicine? Could I do that? [Interviewer switches out medicine bottles and blood pressure cuff] Student: Yes. Interviewer: Yes, I could do that? That would be okay? Student: Because I think doctors give people vitamins when they're done. Interviewer: When they're done, okay. So, let me ask you this. Could I do this? This to the end, vitamins first, and then medicine, [Interviewer swaps out thermometer and vitamins, so that vitamins are first and thermometer is last in the sequence] Does that make sense? [student shakes head] No? Tell me why. Student: Because they can probably get sick if it ... from the shot. Interviewer: They'll get sick from the shot? Student: Yes, probably. Interviewer: Probably. And so, if they get sick from the shot ... Student: They can probably get sick. Interviewer: Oh. So, if I give him the medicine and then I give him a shot, he'll get sick. Do you think? Student: Probably. Revealing CT, the student provides a rationale regarding the sequence of steps. Interviewer: Probably? Can I take his temperature at the end? Does it make sense to take his temperature at the end to see if he's sick? Student: No. Interviewer: No? Student: Because if he's sick- Interviewer: Yeah. Student: ... you might have to give him a shot. Interviewer: Yeah? Yeah. Maybe right. Okay. One more thing. Could I do that? [interviewer re-ordered tools, swapping out thermometer with BandAid - so order is now: vitamins, syringe, thermometer, blood pressure cuff, stethoscope, bandage] Student No, because this, once I give him a shot, he would probably bleed, and you'd have to keep wiping him. Interviewer: Yes. Student: And then, when you're done with it, you got to give him ... You got to keep wiping him and then give him the Band-Aid. Interviewer: So, if I don't put the Band-Aid on immediately, I'll have to keep wiping him, or while I'm doing all these other things because he'll be bleeding. You're smarter than I am.

Supplemental Table 2. Library Tasks Vignettes

Tatiana	Interviewer: What kind of books do you like to read? Student: Princess books. Interviewer: Princess books. Tell me why. Student: Because I'm a girl and I like princesses. Interviewer: Because you're a girl and you like princesses, that's enough of a reason. Okay. What are your favorite books? Do you remember your favorite books, any of your favorite books? Student: I like Sleeping Beauty. Interviewer: Sleeping Beauty, okay! So tell me about that. If you had to describe Sleeping Beauty with three words, just 3 words, to someone who had never read sleeping beauty before, what would be the three words you would use to describe it. Student: Magic Interviewer: Magical? Magical. Okay. What else would you use? I'm going to write your words down. For Sleeping Beauty...you would choose magical. Student: Not magical, magic. Interviewer: Magic. Magic, excuse me, what other word would you pick? Student: Beautiful. Interviewer: Beautiful. What other word would you pick? Student: Love Interviewer: Magic, beautiful, love...how about one more? Is there another word that you can pick to describe the book Sleeping Beauty, so that someone would know what it's about or how to find it? Student: Hmm, I would say, how are you? Interviewer: How are you? Student: Yeah. Interviewer: So tell me...what is Sleeping Beauty about? What is Sleeping Beauty? She is a... Student: Princess. Interviewer: Princess. Do you think you might use the word princess...to describe it? [Students nods no] No, you wouldn't use the word princess to describe it? Student: No, because she's already a princess so we don't have to write princess again. Interviewer: True, but Sleeping Beauty, those two words aren't actually the word princess, they're just Sleeping Beauty. Student: I know. Interviewer: But you wouldn't use the word princess? Student: No. Interviewer: No word princess. Student: I would just use Sleeping Beauty. Interviewer: You would... okay... but if you couldn't say Sleeping Beauty, if I said... say, "you can describe Sleeping Beauty but you can't say Sleeping Beauty", you would say "magic", "beautiful", "love", "how are you". Student: I made a mistake on how are you. Interviewer: You wouldn't say "how are you"? Okay, I'll switch that around. And would you say any other words? Student: Yeah. Interviewer: What, tell me? Student: I would say...lovely! Interviewer: Lovely, okay. I like that one.
Charlie	Interviewer: Okay. I'll get you another one, and you're going to tell me... All right. Have you ever seen that book before? Student: No. Interviewer: No. Oh, it's a brand new book for you? Student: Mm-hmm. Interviewer: Okay. So tell me, what do you think it's about? Student: I think it's about animals that are in the winter.

	Interviewer: Oh, animals in the winter? Okay. Any other words you think you might use to describe it? Student: Probably about the stuff that is in the winter. Interviewer: About the stuff that is in the winter? Like what? Student: Like trees with snow. Interviewer: Trees with snow? Yes. So you might say trees with snow, animals, winter. Anything else? Student: Ice. Interviewer: Ice. Did you say ice? Those all sound like really good search terms. Would thunder be a good search term for this book? Thunder. Student: A snowstorm. Interviewer: Maybe snowfall, but not thunder? Okay, okay. Would Wagner School (pseudonym for the student's own elementary school) be a good search term to find this book? Student: No. Interviewer: No. Why not? Student: Because that's not in the city. Interviewer: It's not in the city of this book? Student: Yes. Interviewer: Okay. All right. Do you want to flip it over so you can see the name of it?