

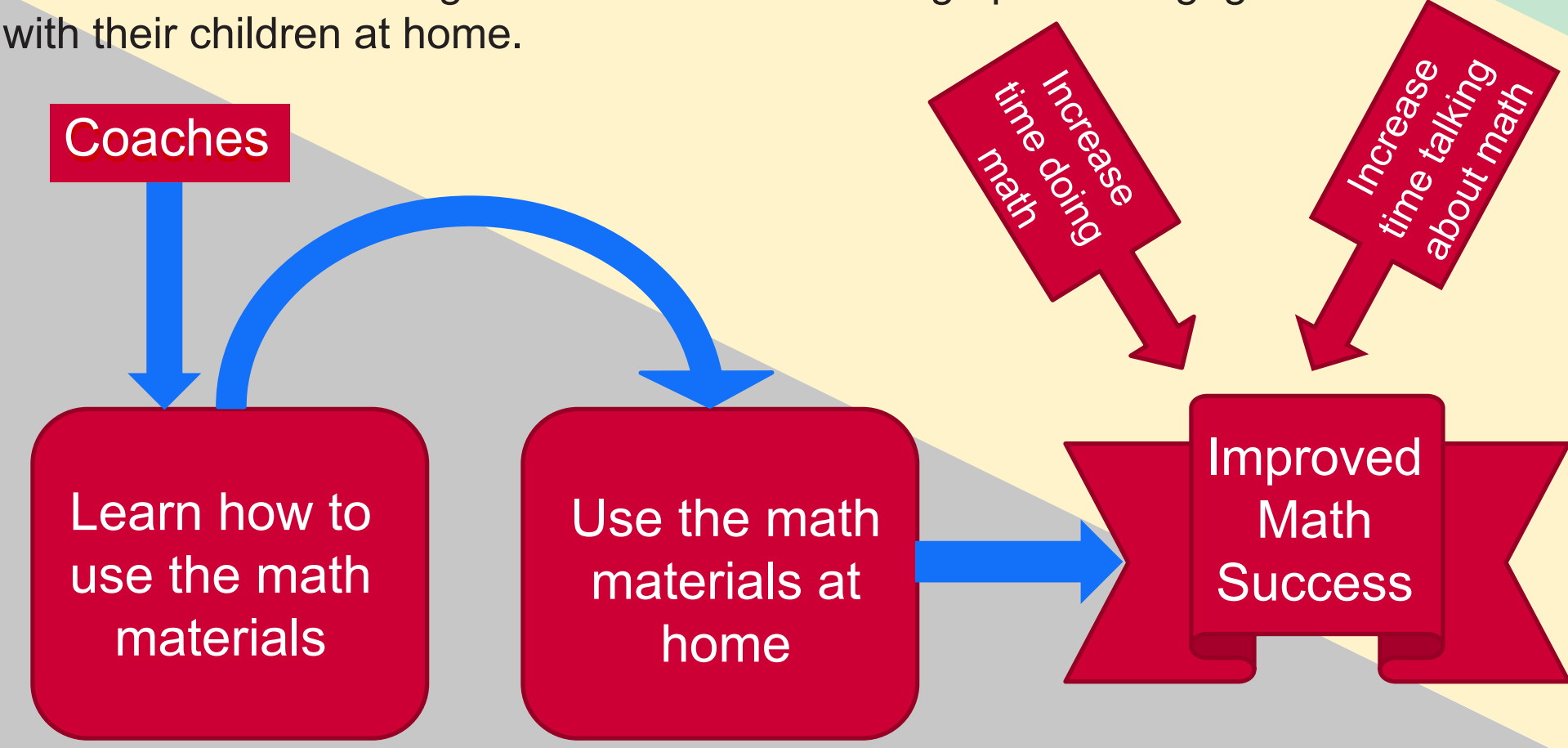
Encouraging Parent-Child Interactions in Mathematics at Home: Research on Materials Development



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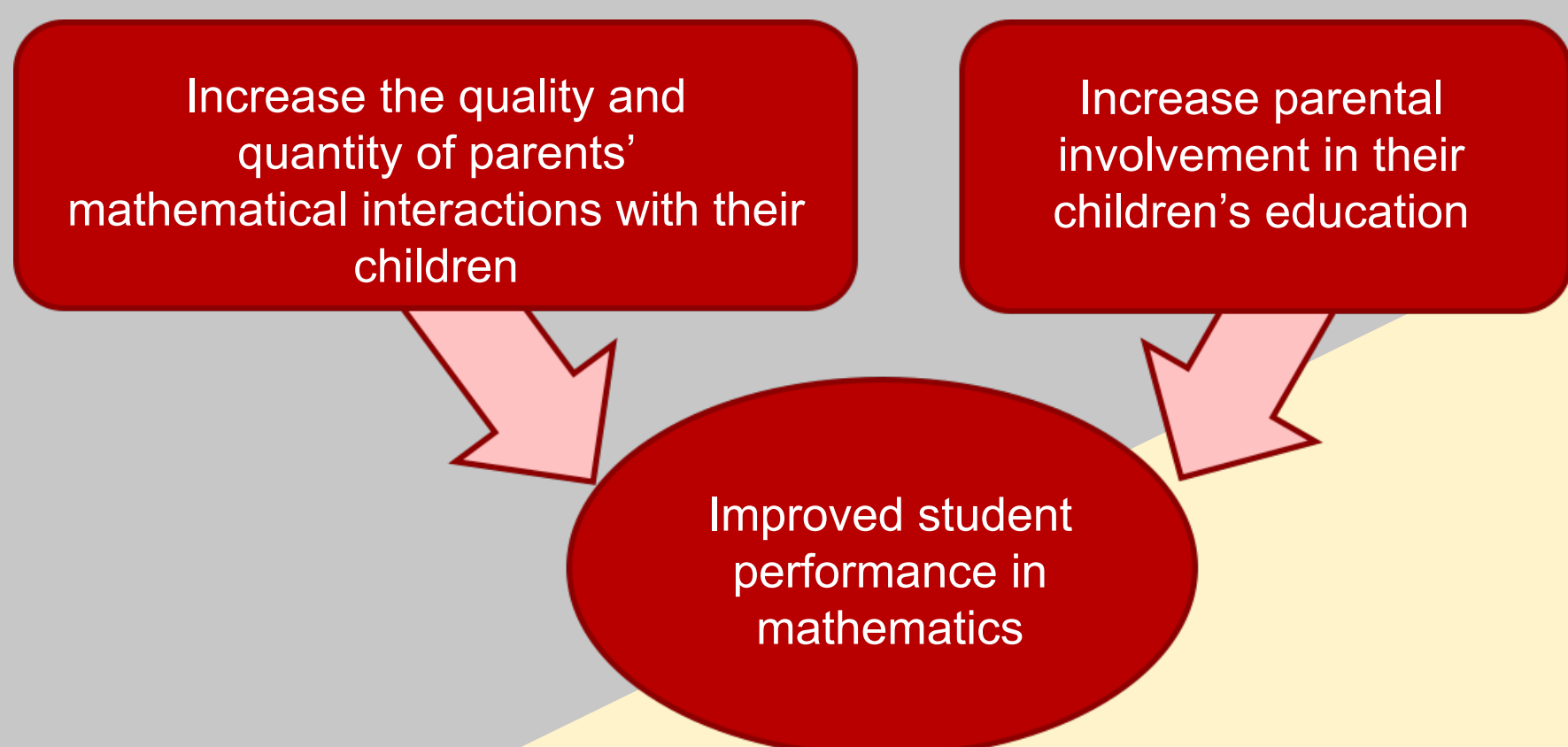
Abstract

In this presentation, we describe a project being implemented in low-income communities in Jamaica to help parents engage with their children in mathematics-related activities at the home. Through activities implemented as part of this project, we provide parents with (a) background on the mathematics topics their children are learning in school; (b) training on how to use mathematics games and storybooks specially designed to focus on relevant mathematics concepts; and (c) support from on-site coaches. The purpose of this presentation is to describe the research activities that were implemented to develop mathematics learning materials for this project. First, we report findings from a series of focus groups conducted with parents, teachers, community members, and members of the Jamaican Ministry of Education (MoE) to design materials that would be engaging and relevant for parents in Jamaica. Next, we describe the procedures and outcomes of a feasibility study conducted with a small sample of parents in Jamaica during which draft mathematics learning materials were distributed to determine their feasibility. As a result of these research activities, we refined the mathematics learning materials to be maximally relevant, interesting, and feasible for parents to use with their children. We propose that the research methods described in this presentation may support other organizations' efforts to design materials that encourage parent engagement in mathematics with their children at home.



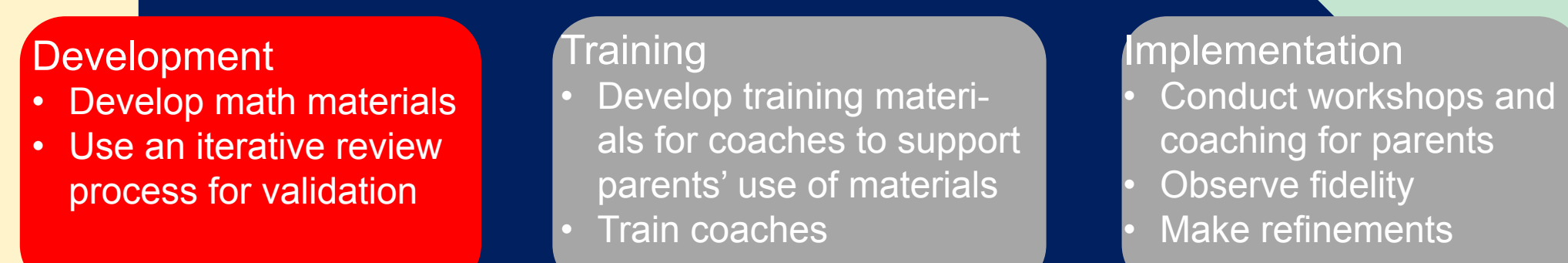
Literature

- Research across multiple content areas and grade levels suggests that parental involvement in children's education can be positively related to academic achievement (Blevins-Knabe & Musun-Miller, 1996; Department for Children, Schools, & Families, 2008; Fan & Chen, 2001; Miedel & Reynolds, 1999; Munroe, 2009; Olatoye & Agbatogun, 2009).
- Examination of the relation between parental involvement and performance on mathematics tasks indicates a modest correlation of $r = .18$ (Fan & Chen, 2001).
- In a small study with 49 kindergarteners, Blevins-Knabe and Musun-Miller (1996) observed that, in general, children whose parents reported spending more time on mathematics-related activities in the home earned higher scores on a standardized test of early mathematics ability.



Phases of the Project

The project has three main phases: (1) Development of the mathematics learning materials, (2) Training of coaches, and (3) Implementation of mathematics learning materials through parent workshops.



Phase 1- Development

The purpose of this presentation is to describe the first phase, which is the iterative development and validation of materials prior to finalizing the materials, training coaches, and implementing the materials with parents.

Focus Groups

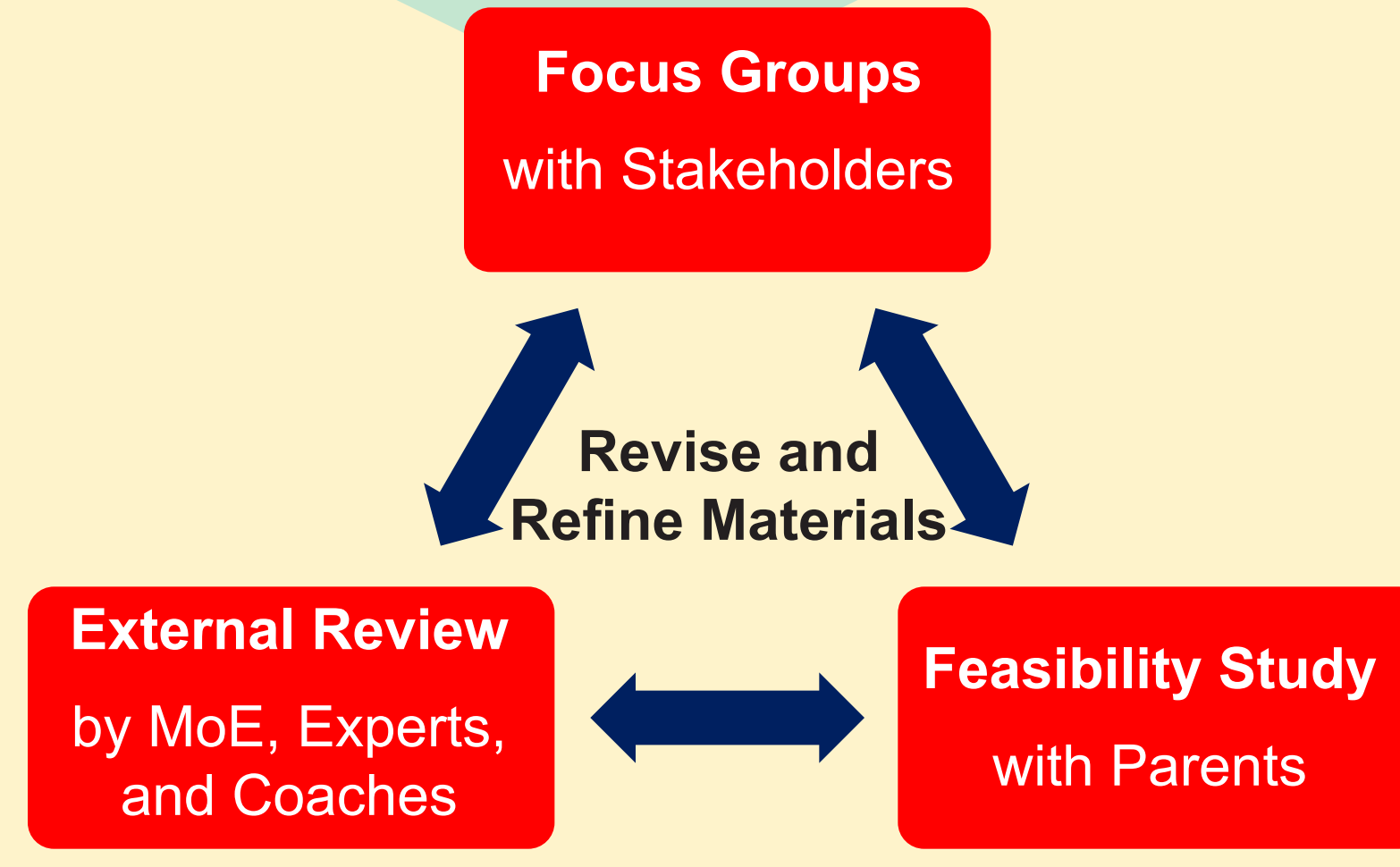
Purpose: Conduct six focus groups with different stakeholders to (a) evaluate the relevance of the prototype learning materials, and (b) develop a better understanding of the Jamaican education system and culture.

Sample: Four focus groups comprising (a) members of the Ministry of Education (MoE), (b) curriculum developers, (c) teachers, and (d) parents/caregivers to obtain their input on the prototype learning materials we created. Two additional focus groups comprising (a) community leaders and (b) members of local advocacy groups were conducted to better understand the Jamaican education system and culture.

Methods: Prototype materials were developed by the research team and presented during each focus group. Input was solicited on the accessibility of the materials for parents, especially given the low rates of literacy; the cultural relevancy of the games, characters, and story lines for Jamaican families; ease of implementation and dissemination with parents; and other cultural considerations that may impact the success of the project. Each focus group lasted approximately 1-2 hours. Field notes and audio or video recordings were obtained and subsequently analyzed for themes.

Themes that Emerged from the Focus Groups

- Increase accessibility for parents:** Stakeholders suggested using readily available materials (e.g., dominos, bottle caps) in games. For example, paper clips (used in game) are not easily available. Also, the game directions were text-heavy and parents in the sample have low literacy levels.
- Increase cultural relevancy of materials:** Stakeholders pointed out that some of the words and/or phrases are not used in Jamaica. For example, the word "freeway" was not used locally. Stakeholders suggested using Jamaican names within books and using culturally relevant math examples while teaching content.
- Increase the reliability of the language:** Stakeholders noted that scripting in the sample materials resembled that of a teacher. Stakeholders suggested minimizing the amount of "teacher speak" to make materials more parent-friendly. For example, instead of saying "What is another strategy?" stakeholders recommended changing the phrasing to more approachable language such as "Show me another way".
- Script the materials for replication and ease of training:** To support future implementation of the project and potential scalability, the mathematics learning materials will be scripted for each workshop.
- Use relatable characters that persist throughout the materials:** Stakeholders suggested that using consistent characters in the books would engage children and families as they progressed through the workshops.
- Make the games and activities seem less like homework:** Stakeholders shared that since the game was paper-pencil based, it seemed more like "homework" than a fun activity to do at home. Stakeholders suggested including multiple activities per workshop and focusing in the game aspect of the activity to increase engagement and enjoyment.
- Incorporate gender sensitivity issues and cultural conceptions of math during development of materials and during workshops:** Stakeholders shared concerns about the widespread fear of mathematics, noting that there is a "cultural fear of mathematics." Stakeholders also referenced the perception of differential ability in mathematics based on gender, and suggested that the materials overtly work to dispel this misconception.



Feasibility Study

Purpose: A small scale feasibility study was conducted to determine if the project design was feasible for implementation.

Sample: Seven parents or caregivers of children in grades 1 or 2 were selected by the MoE to participate in the feasibility study. Parents resided in a rural community and received federal assistance. All participating parents/caregivers were female.

Methods: A Jamaican educator was selected by the MoE to support the feasibility study. The educator received one day of training on how to implement the mathematics learning materials with parents in a workshop format. The following day, the educator conducted the workshop at a convenient location. The workshop lasted for approximately 3 hours.

During the workshop, parents received training on how to use the mathematics learning materials and were instructed to engage with their children prior to returning. At the follow-up session, parents described their experiences as they played the games and/or read the storybook with their children. Field notes and audio or video recordings were obtained and subsequently analyzed for themes. Data on the educator's fidelity of implementation were analyzed.

Themes that Emerged from the Feasibility Study

- Design is feasible:** The project design was feasible to implement. The educator was able to deliver the material with a high degree of fidelity after receiving training.
- The materials and manipulatives are usable for the educator and parents.** The educator was able to use the materials effectively throughout the workshop. The parents were able to engage with the materials during the workshop. Of the three parents who came to the follow-up session, all were able to successfully play the game with their children after the workshop. One of the returning parents read the storybook with her children without any challenges. The other two parents did not read the storybook due to time constraints.
- The materials are appropriately challenging for children.** In the follow-up session, all parents agreed that the games and questions in the storybook were appropriately challenging for their children.
- The materials are fun and engaging for parents and children.** During the workshop, parents appeared to have fun engaging with the materials and working with the educator. During the follow-up session, parents reported that they had fun learning the material during the workshop and liked working together with other parents. Parents also reported that the game was fun to play with their children.
- Streamline the content delivered in the workshop.** During the training session with the educator, the script was modified to improve clarity and more actively engage parents. To deliver the workshop as scripted, the educator spent over 3 hours with the parents or caregivers. Because the workshop is intended to last about 2 hours, the amount of content was reduced for future workshops.

Sample Revised Materials

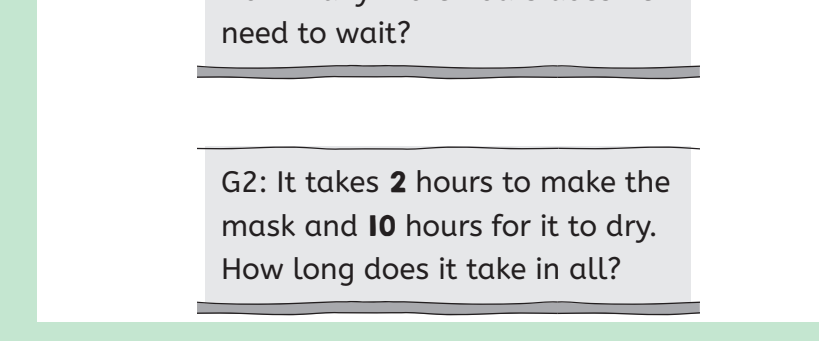
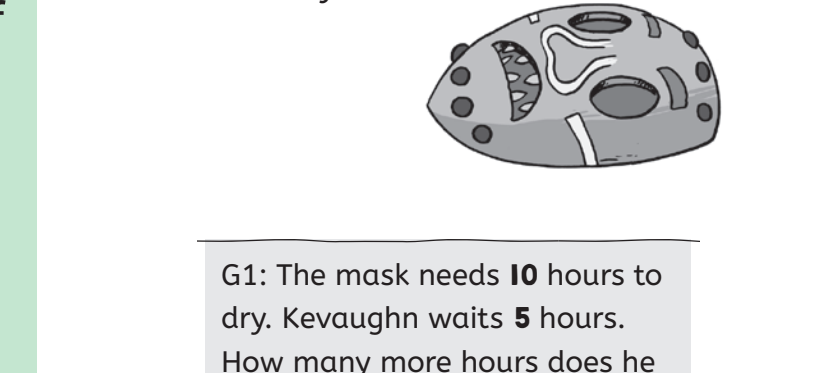
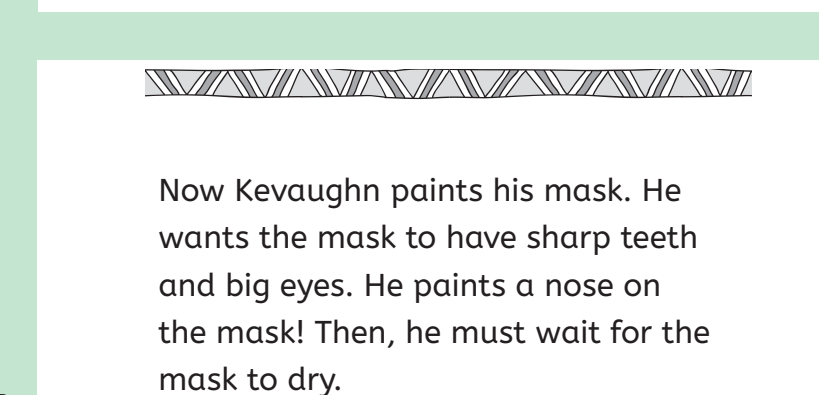
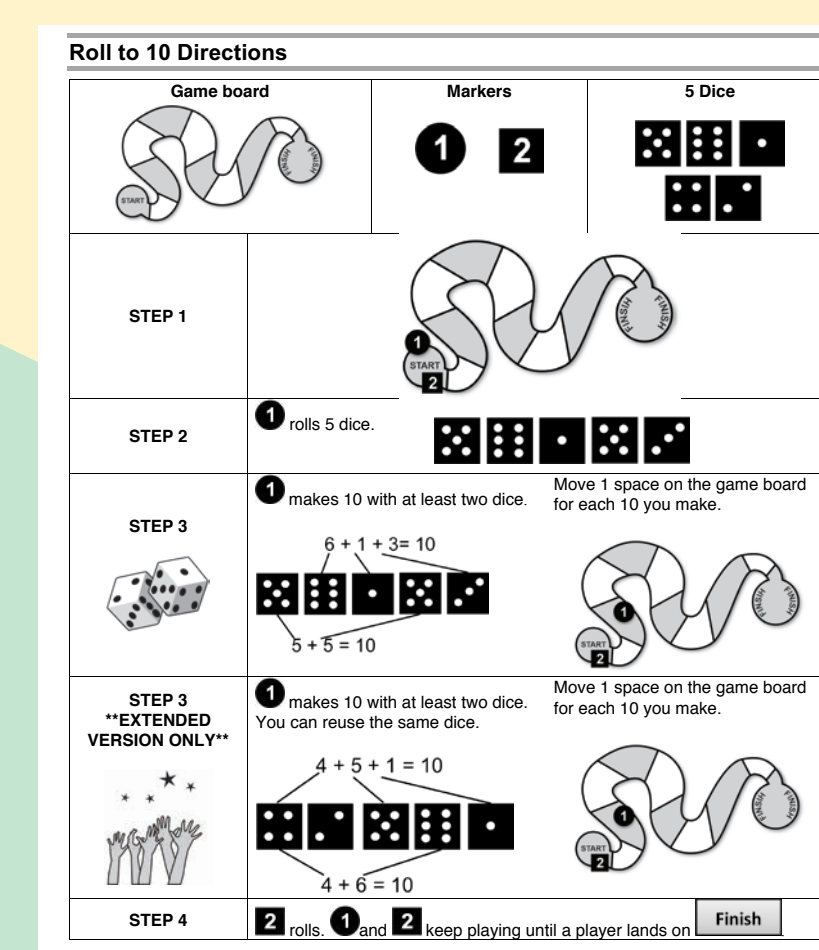
Using the themes that emerged from the focus groups and feasibility study, revisions were made to the design of the mathematics learning materials.

- Accessibility:**
- Principles of universal design were implemented throughout the mathematics learning materials.
 - The amount of text in the game directions and other materials was reduced.
 - All materials are provided to the parents or are readily available (e.g., pebbles, bottle caps)

- Relatability:**
- The interactivity of the games was increased.
 - Language was revised to increase relatability.
 - The "school-like feel" was reduced by making the materials appear less like homework and making the language more approachable.

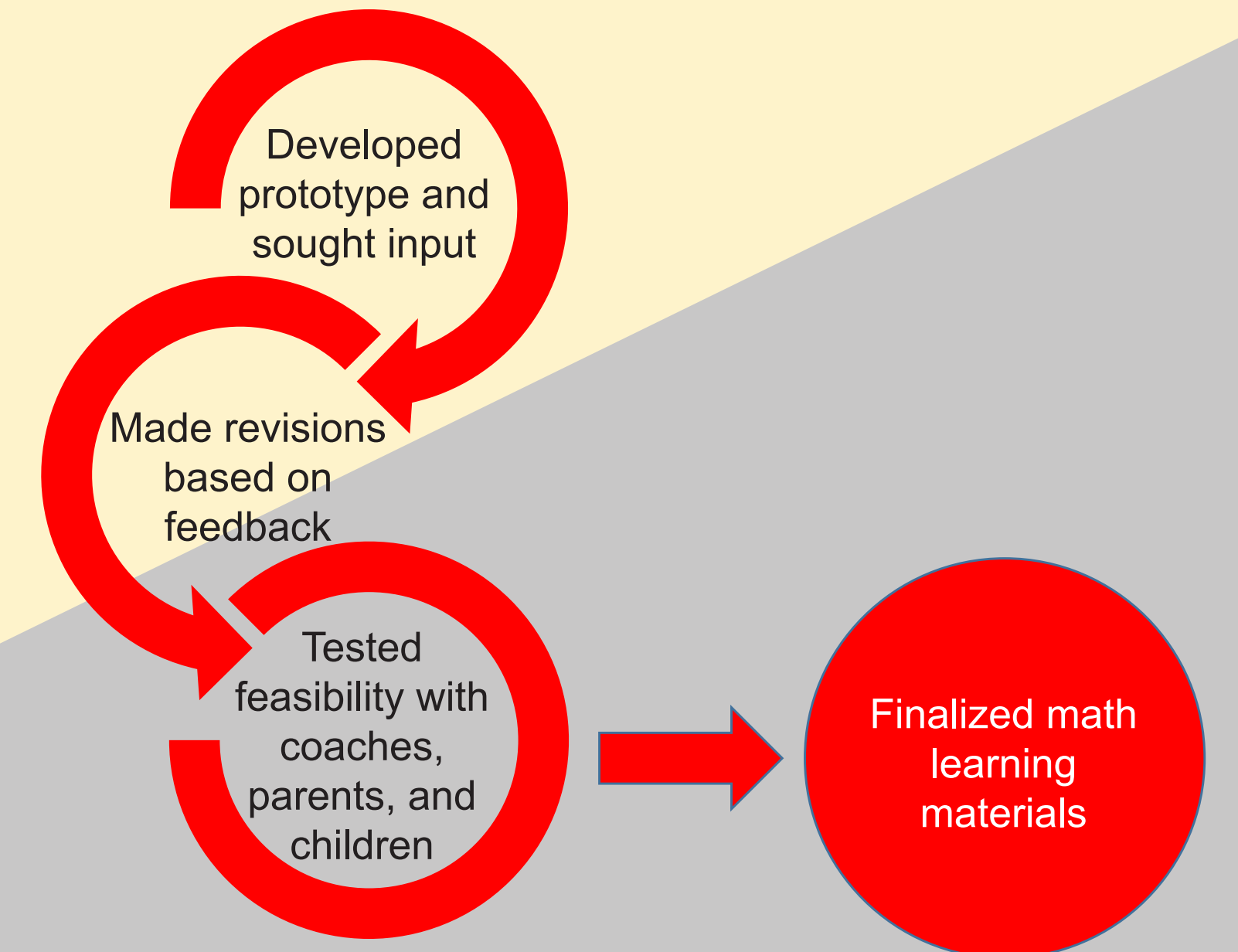
- Cultural relevancy:**
- Story lines used in the books are representative of the Jamaican culture. An expert in Jamaican cultural studies reviewed the books for cultural sensitivity and revisions were made based on feedback received.
 - Two main characters are used for all of the storybooks across workshops.

- Gender sensitivity:**
- Efforts were taken to reduce math anxiety by including a jingle and encouraging parent engagement.
 - One of the main characters in the storybook is a girl who enjoys and actively engages in mathematics.



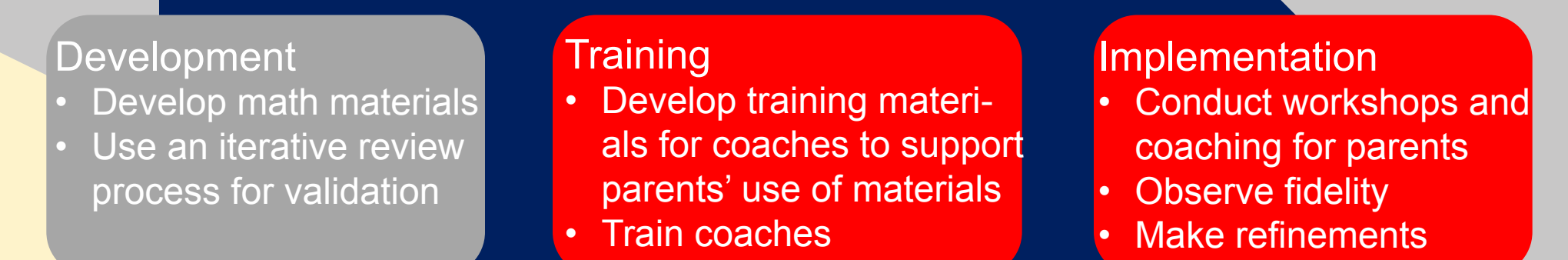
Conclusions

- The purpose of the first phase of this project was to develop mathematics learning materials for parents to use with their children based on principles of explicit instruction and universal design.
- The materials were finalized after a rigorous review cycle in which we implemented an iterative development mechanism.
- Input was solicited from a broad range of stakeholders on prototype materials. We revised materials based on feedback, implemented feasibility studies with parents, and subsequently made additional revisions prior to finalizing materials.
- We hypothesize that these validated and culturally-relevant materials will be helpful to parents and will increase their quality and quantity of interactions with their children, eventually impacting the children's performance in math.



Next Steps

- Development of 6 workshops based on the iterative design process.
- Solicit and incorporate feedback and input from the Jamaican Ministry of Education, the coaches, and a cultural expert.
- Conduct feasibility studies for each workshop using a convenient sample of participants in the U.S.
- Training of coaches using coaches' guides and other training materials will continue through the end of the project.
- Implementation of the randomized control trial with 1600 families February 2017 through August 2017.



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Acknowledgments

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