the activity, a task intended to prompt children's thinking at a given level, and suggestions for extending the opportunities for children's learning. Adaptations to the investigations followed the framework of considering the environment, materials, and instruction [20,21]. Most investigations included an introduction to a scenario or critical questions, resource lists for additional learning, extensions of the main activity, scripts for practitioners to follow, and formative assessment. Formative assessment included observing a child's response followed by a counter-response from the practitioner that built more foundational knowledge or challenged children beyond the intended levels.

More extended activities with all the components were developed at the beginning of the phase in consultation with STEM subject matter experts. Team members then reviewed these with expertise in ECE or inclusion. Shorter activities were also developed for more rapid testing and revision cycles. Elicitation activities and simple observation of children's natural learning were also part of content development—as observation of what children were interested in and doing revealed examples and non-examples of specific levels of thinking or inspired structures for extending and enriching children's natural play. Across all types of content development, the goal was to align inclusive and developmentally appropriate instruction to the hypothesized learning progression.

birth to 5. These enhancements can be replicated in other work by including multiple voices. In this work, the gathering of anti-ableist perspectives facilitated the identification of exclusionary standards, practices, and research. Without this identification, the project would be more at risk of incorporating language or practices that failed to provide access to learning opportunities. Incorporating new frameworks, such as intentional considerations of the inclusiveness of environment, materials, and instructional practices, further removed this risk. Thus, a priori foundations of the development of learning trajectories are stronger when embracing and protecting perspectives that have previously been segregated or excluded from educational research.

Another key takeaway is the bidirectional benefits of conducting educational research

Including cross-cutting concepts and child-level processes that support learning in those domains was also a new demand in the work. These challenges ensured that the resulting STEM curriculum accurately portrays how children from the earliest ages learn about and apply concepts and skills from these domains, how those early skills are built upon to create more complex, accurate understandings of the world, and how educators, parents, and home visitors effectively move children forward in their STEM journeys. Moreover, the testing of UDL principles and tiered supports, built around modifying the environment, materials, and instruction for the activities and learning experiences, promotes usability for educators and caregivers in all settings and ensures that the needs of every single child can be met within the STEMIE framework. The STEMIE websites (https://stemie.fpg.unc.edu and https://www.learningtrajectories.org/) present the results of this work, including information on complementary publications and direct online access to the learning trajectories.

Limitations and Future Research

To disrupt this paradigm, educational researchers must enhance existing knowledge development frameworks with an anti-ableist and inclusive intent. The anti-ableist lens seeks out exclusionary language, practices, and standards. These must then be replaced by inclusive practices that increase engagement by removing barriers and providing opportunities for all children to reach STEM learning goals. Furthermore, this may include bringing new frameworks into EC and ECSE settings to produce a common language for engaging young children in STEM learning.

Integrating best practices from ECE and ECSE also calls researchers to learn from and with practitioners. This approach enhanced the CRF by elevating the bidirectional and iterative nature of the framework, infusing each phase with voices that challenged the team to consider a variety of individualized and inclusive teaching and learning strategies.

There is great urgency to move beyond the status quo where children with disabilities, particularly those who are multilingual and racially, ethnically, and culturally diverse, continue to be denied opportunities to participate in STEM learning across their environments [26]. Systematically, including and lifting up the voices of multiple perspectives can bring about this crucial change.

Author Contributions: Conceptualization, C.-I.L., D.H.C., M.V. and J.S.; Funding acquisition, C.-I.L., D.H.C., M.V. and J.S.; Investigation, S.S.G., E.B.S. and A.L.H.; Project administration, E.B.S. and A.L.H.; Supervision, C.-I.L., D.H.C., M.V. and J.S.; Writing—original draft, S.S.G.; Writing—review & editing, C.-I.L., 01.67 Tm [04 5.3.879 Tm [(c1(onal)-291(and)]66e)-25S.Gd(an0z0(onal)-291(uthors)-246(have

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