

Powering up: Computer Science for Every Learner Through Culturally Responsive Professional Development

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SUMMARY

This project investigates effective strategies for teaching **introductory computer science (CS)** to **English Learners (ELs)** in two Illinois school districts through the lens of **Culturally Relevant Pedagogy**. The initiative emphasizes the development of core **computational thinking (CT)** practices—including decomposition, pattern recognition, abstraction, and algorithmic thinking—integrated across multiple subject areas.

By embedding CS and CT within linguistically and culturally responsive instructional contexts, this work aims to foster **inclusive, equitable learning environments** that support both language development and computational fluency. The project contributes to a growing body of research focused on expanding access to high-quality CS education for historically marginalized student populations.

HYPOTHESIS

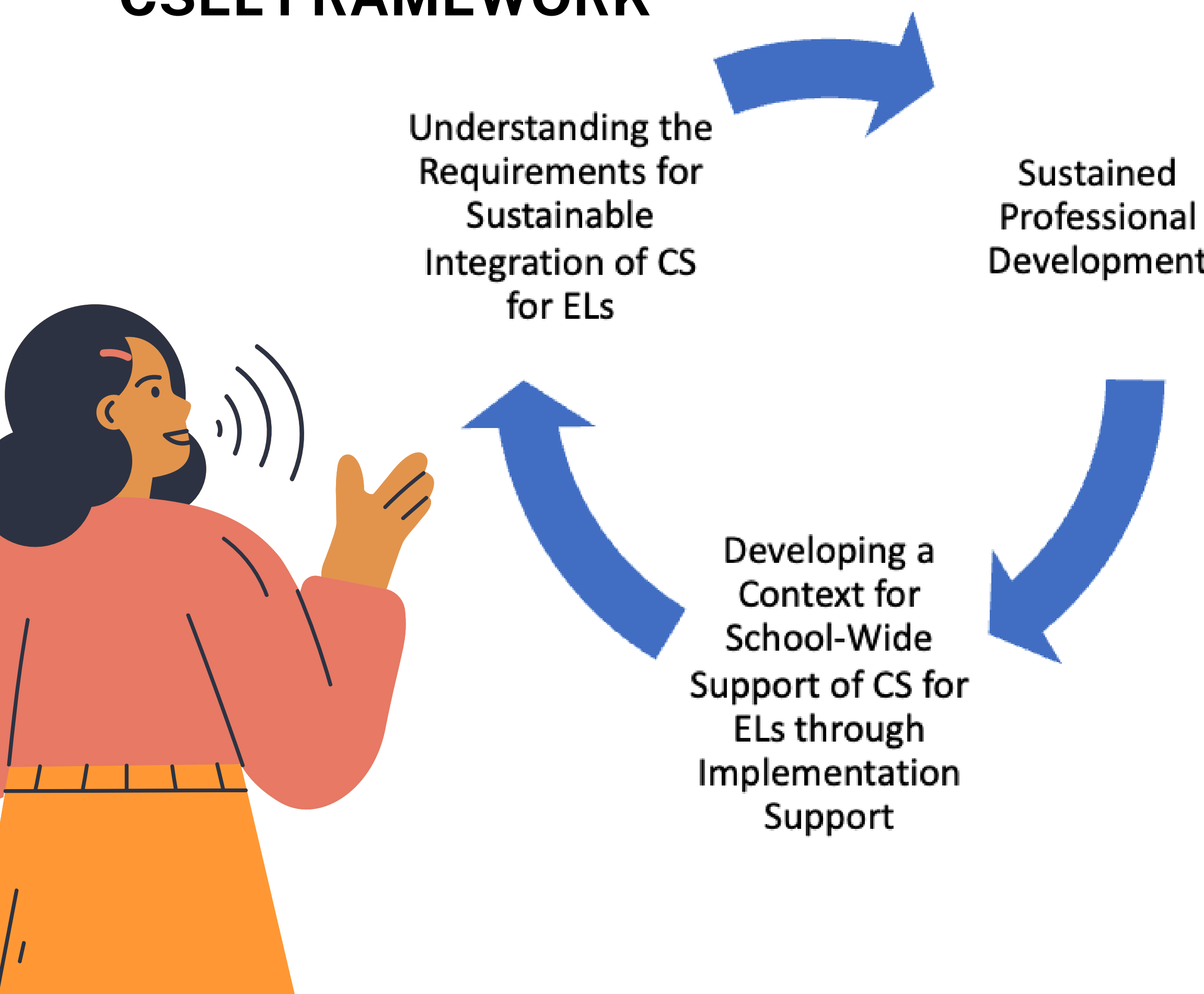
The research examines the hypothesis that **sustained, intensive, and collaborative professional development (PD)** in computer science (CS), when **seamlessly embedded into educators' daily practice**, will foster a supportive, school-wide context and provide the instructional support necessary for **English Learner (EL) teachers** to effectively integrate CS into their teaching.

RESEARCH QUESTIONS

RQ1: What professional development components most effectively support teachers in integrating computer science into EL instruction to foster CS and CT?

- **RA1a:** How does sustained, intensive, and collaborative professional development influence teachers' beliefs about their ability to teach CS to ELs?
- **RA1b:** What changes occur in teachers' instructional practices for integrating CS concepts into EL instruction after participating in extended professional development?
- **RA1c:** What systemic factors (e.g., leadership support, school resources) facilitate or hinder the successful integration of CS in EL instruction?
- **RA1d:** What is the impact of integrating CS into EL instruction on EL students' acquisition of both computational and linguistic skills?

CSEL FRAMEWORK



RESEARCH METHODOLOGY

The research questions guiding this project aim to explore the **professional learning experiences** of educators and to identify the **supports necessary for integrating CS skills** into instruction for **ELs**. Specifically, the study will investigate **teacher beliefs** and **instructional practices** related to CS and ELs.

To address these questions, the project will employ a **multiple case study design**, conducting **3–5 in-depth case studies** of K–5 educators who teach ELs and are participating in a **school-wide CS integration initiative**.

Each participating teacher will engage in sustained **PD facilitated by BootUp PD**, which includes:

- Interactive workshops
- Model teaching and instructional coaching
- Capstone projects
- A professional learning course for instructional coaches

The PD emphasizes both **technological and pedagogical components**, with a focus on implementing **Scratch or ScratchJr** as accessible, age-appropriate platforms for CS instruction.

DATA COLLECTION

Data will be analyzed using both **quantitative and qualitative methods**. The analysis will begin with a **within-case analysis**, providing a detailed description and thematic exploration of each individual case. This will include identifying key patterns related to teacher beliefs, instructional practices, and the integration of CS for ELs.

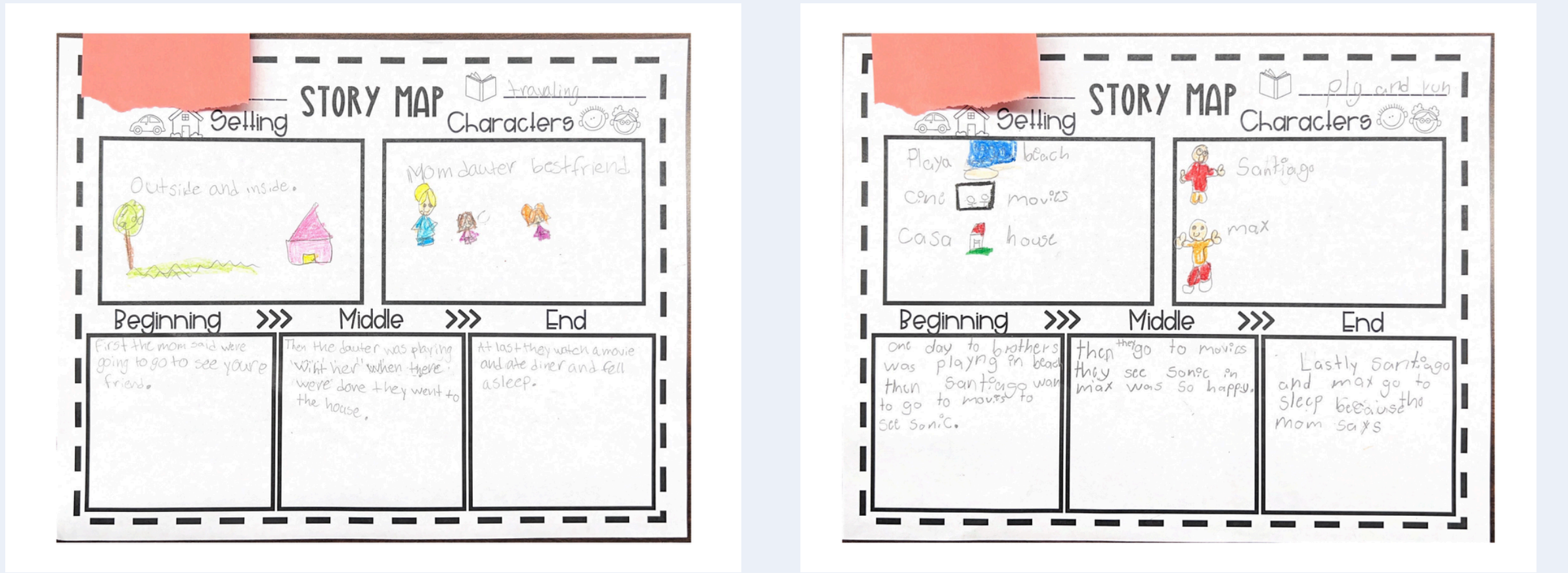
Following the within-case analysis, a **cross-case analysis** will be conducted to identify common themes, variations, and broader implications across all cases. This comparative approach will support a deeper understanding of the collective findings and inform interpretations relevant to **CS integration** within **linguistically diverse elementary learning environments**.

	SURVEY	CLASSROOM OBSERVATIONS	INTERVIEW	CAPSTONE PROJECT
POINT OF COLLECTION	Beginning and end of every project year	End of third project year	Midpoint of every projet year	Midpoint of every project year
TYPE OF DATA	Provide baseline and evidence of change in teacher beliefs and efficacy related to teaching CT for all teachers in PDTeacher self-reports on instruction	Qualitative observation data on instructional practices	Qualitative data on the process of changes in teacher beliefs and efficacy for case study teachersQualitative self-reported data on instructional practices	Qualitative data on integration of CT practices into teacher instruction Qualitative data on student learning

	DESIRED OUTCOMES	COMPUTER SCIENCE PD (BOOTUP)	IMPLEMENTATION PD (CS FOR SUCCESS)
YEAR 1 “I DO”	• Completion of Capstone Projects	• PD focuses on providing direct support to teachers • Teachers receive coaching outside of their PD sessions	• One-on-one implementation meetings on an as-needed basis
YEAR 2 “WE DO”	• Completion of Capstone Projects, Creation of Implementation Plan	• PD focuses on building teacher confidence by integrating CS skills into their instruction to their EL students • Bootup Facilitators will co-teach lessons with teachers	• Project team completes 4-hour Implementation PD • Admin attends all BootUp PD sessions
YEAR 3 “YOU DO”	• Assess the sustainability of Implementation Plan, Align vision statement and goals	• PD will focus on promoting long-term sustainability and integration practices. • Teachers will lead lesson instruction	• Project team completes 4-hour Implementation PD • Admin attends all BootUp PD sessions



STUDENT MATERIALS



INSIGHTS

- In a bilingual classroom, coding becomes a powerful third language—developing problem-solving, communication, and multiliteracy skills.
- With explicit instruction and peer support, students can grow as confident creators across all three languages: English, Spanish, and code.
- Through the process of animating sight words and presenting their coding projects, students had meaningful opportunities to practice academic vocabulary, sequencing, and oral communication in English.

CHALLENGES

- While Scratch is able to change the interface language, it was still a challenge to introduce programming vocabulary and academic instructions in English
- Time constraints made it difficult to fully guide students through the creative and technical steps of Scratch projects
- Teacher self-report that confidence was a barrier in their implementation and instruction of final capstone lessons.

KEY RESEARCH FINDINGS

Initial data analysis after Year 1 of PD shows that:

- EL students feel ownership over coding activities and feel supported by the use of their native language.
- Some teachers initially have lower self-efficacy for coding, but student excitement and engagement encourages teachers
- Some teachers see the relevance of coding to their curriculum, however, some teachers prefer to teach coding after school rather than integrating it

RECOMMENDED MODIFICATIONS

- Create a culture of support for CS education for ELs within each participating district by providing Administrator PD focused on setting implementation goals for the coming year and reviewing PD progress of the previous year.
- Support teacher's in building confidence in their CS skills by aligning the deadlines for the annual CS capstone project with the PD timeline so the project becomes integrated into PD sessions.