Explore the Use of Artificial Intelligence to Co-Design Inclusive Teaching Practices

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***Abstract*— During COVID-19 times, children have struggled with learning environments with limited opportunities for social interaction and resources. Artificial Intelligence (AI) shows positive results to develop their academic and social emotional learning outcomes. The research paper investigated a co-design process for special education teachers to design inclusive teaching practices for students with disabilities. Specifically, this co-design process utilized Artificial Intelligence (AI) as a catalyst for helping teachers acquire design skills needed to include more collaborative, culturally relevant practices. The research conducted a case study to capture how in-service special education teachers used AI to design inclusive practices. The results showed that the co-design process led to growth of participants' ability to design inclusive practices. Qualitative analysis based on teacher interviews, lesson projects, and field notes also suggested that the shifts in participant's ability to design is influenced by a variety of personal and contextual factors including i) the usefulness of AI for inclusive education; (ii) teachers' attitudes about the role of the teacher as a designer, and (iii) leadership support.**

Keywords—Assistive technology, inclusive education, special education, teacher education, co-design process

I. Introduction and Literature Review

Artificial Intelligence (AI) has its academic roots in the early twentieth century that widely applied in educational practices (Artificial Intelligence in Education; AIED) [1]. It is a growing field which promotes innovations and developments that include the use of computers, machines, and other artifacts with human-like intelligence characterized by cognitive abilities, learning, and decision-making capabilities [2, 3]. Motivated by a growing interest in preparing children for jobs that have become increasingly technical in nature, AI has leveraged new learning opportunities to facilitate paradigm shifts for instructional design, knowledge building, and education research [4, 5]. Considering growing initiatives in AI, researchers have strived to understand, design, and build intelligent computational artifacts into the curriculum. This includes coding-based programs that can spark children's curiosity in childhood, and socially intelligent agents that can detect emotion as a non-invasive approach for children with disabilities such as autism. AI has shown promise for developing children's social-emotional skills and strengthening their problem-solving ability in complex environments.

AI has been widely used in K-12 learning environments and leverages learning opportunities for young children to engage in classroom learning, collaborating with peers, and solving problems with responsive feedback [6]. These practices ranged from engaging intelligent tutoring systems [7], designing teachable machines, performing learning analytics to understand learning behaviors, and utilizing adaptive learning systems to maximize learning potential, and facilitating human-computer interaction and collaborations. Adaptive learning systems and social robots were mostly being used for children in family and community settings [8]. Intelligent tutoring systems have demonstrated a moderate effect on children's learning achievement [9, 10].

Even though AI serves as a "catalyst" [11] to make changes in teaching and learning, it has historically been implemented inequitably across schools. As a result, children who come from socially and economically disadvantaged communities often have limited resources and curriculum compared to the children in the mainstream classrooms [11]. This deficit teaching model has historically hindered children's academic success, especially when schools and teachers categorize children with special needs, and do not understand that children with special needs are capable of success, especially when they are able to learn through AI curriculum [12].

Moreover, cultural stereotypes and deficit thinking might be roadblocks to persuade teachers to re-conceptualize their preconceived notions about children with disabilities, and view children as capable learners who can benefit from the AI curriculum. Teachers who employ cultural stereotypes and deficit thinking could easily create inaccurate characterizations of academic ability to children based on race, ethnicity, and special learning accommodations. To achieve the goal of an AI education-ready populace, teachers and administrators need to become more deeply involved in multi-fold issues of equity and design an authentic culturally inclusive learning environment. The study aims to conduct in-depth analysis to explore current practice in AI for children with diverse learning needs in K-12 schools and associated communities

Therefore, the study investigated a co-design process for special education teachers to design inclusive teaching practices for students with disabilities. Specifically, this co-design process utilized Artificial Intelligence (AI) as a catalyst for helping teachers acquire design skills needed to include more collaborative, inquiry-based practices. It introduces effective teaching practices based on the learning sciences that can help teachers bring students back into full engagement in the classroom and demonstrates multiple ways to use AT to meet the needs of diverse learners [14, 15].

II. Research Questions

This study would focus on two core research questions including: i) how could the co-design process prepare special education teachers to design inclusive teaching practices for students with disabilities? ii) what school-based supports are critical for developing inquiry-based projects in inclusive classrooms?

III. Research Design

The research conducted a case study to capture how in-service special education teachers used AI to design inclusive practices. The study was implemented in inclusive classroom settings in both public and private elementary schools in the New York City and Connecticut areas. Both school districts have diverse urban centers, and populations of learners with diverse learning needs. A total of five teachers were recruited, including teachers who (i) were full-time employees in inclusive classrooms; (ii) those who had at least one to two years of teaching experience; and (iii) a demonstrated commitment to participating in a six-month intervention.

A. Procedures

Because "situating" is a critical element of the co-design process for working with teachers, the researcher began by meeting with teachers and administrators to understand the school and classroom context and identify their needs. The co-design session initially provided an overview and introduced participating teachers to share their perspectives on the usefulness of assistive technology followed by five small-group sessions. Participants were able to explore higher-order thinking tasks, rethink the use of AT, discuss how to effectively facilitate student discourse and community learning, and develop problem-solving and research skills to facilitate students' understanding through different types of assessments (e.g., formative, summative, and pre-assessments). Also, in each session, teachers who participated in the study had small group discussions in Zoom breakout rooms to share common challenges in special education classrooms and propose potential solutions to enrich class projects and design projects to nurture an inquiry-based learning environment.

After five small group sessions, the researcher and teacher participants worked together to co-design and implemented a pilot project and reflected on how the approach could be adopted by other teachers during the COVID times. To model the effective use of assistive technology in classroom teaching, the researcher also conducted a series classroom implementation to provide ongoing support for teachers throughout the co-design process. Towards the end of the co-design process, the researcher guided teachers to reflect the value of AT to design students' learning experiences, scaffold the learning process in order to meet the needs for diverse learners.

B. Instruments

The interview protocol invited teachers to share internal and external factors that might facilitate and/or inhibit the implementation of inclusive teaching practices. The interview was conducted before and after the intervention period. A validated classroom observation protocol was administered weekly to capture how teachers utilized technology to deliver instruction, differentiation, and create an inclusive learning environment [16].

C. Data Collection and Analysis

Qualitatively, the study utilized teacher interviews to explore the contextual and personal factors that affect the learning development of in-service special education teacher leaders. The classroom observation was conducted to understand how the participating teachers utilize technology in classroom practices. Also, the researcher collected lesson plans and student artifacts to capture teachers' knowledge and practices in designing inclusive teaching practices within the school community.

IV. Results

Finding(s) suggested that the co-design process has a positive impact on participants' design ability for inclusive teaching practices. Four themes were identified in analyzing special education teachers' ability to design projects.

A. The Usefulness of AI for Inclusive Education

Emerging themes from the field notes and interviews suggested that teachers perceived the usefulness of AI to differentiate instruction that supported students with disabilities. During the interview, teachers in School I expressed this: by visualizing the graphs, students could more easily understand the concepts of polynomial models. One teacher from School II shared that "combining drama with technologies was a fun way to make STEM projects and develop students' creativity" in the implementation phase. The teacher participants took an active approach to work with the researcher to incorporate different hands-on challenges into their daily classroom teaching to support students with disabilities.

B. Teachers' Attitudes about the Role of the Teacher as a Designer

Field notes and teacher interviews suggested that teachers were gradually aware the value of design and felt excited that their students were more engaged in the inclusive teaching projects. In School I, teachers recognized the value of engaging students in hands-on projects that further developed students' problem solving and analytical thinking skills through the design process. A teacher from School I explained, "Students will learn about their personal impact on our climate and immediate environment and how that can be measured [through this process]." Teachers identified the common advantages to become designers to create inclusive teaching experience. This included to design inclusive lesson plans that helped students to make connections with abstract concepts, incorporated the visual phonics to develop students' foundational reading and writing abilities, and encouraged students to conduct research to deepen their knowledge of the ideas.

C. Leadership Support

Leadership support was identified from the qualitative analysis of the teacher interviews. Although administrators expressed the need to support and develop teachers' ability to design curriculum, teachers expressed the need for administrative support to do the work. In School I, the school principal encouraged teachers to rethink the existing curricula in special needs classrooms in order to design inclusive teaching practices In School II, the teachers approached their principal and expressed the need to think about AT tools to support interdisciplinary, culturally relevant projects while engaging students' interests across disciplines.

V. Significance and Conclusions

The study seeks a new way to explore the co-design process to support teachers who serve students with disabilities in the field of special education. The overall results suggested that the shifts in participant's ability to design is influenced by a variety of personal and contextual factors. Strengthening the design capacity for special education is critical for developing teacher practices and giving them ownership to design projects that are inclusive and culturally meaningful for students with special needs.

In refuting a "separate but equal" policy that has been traditionally implemented for students with disabilities [17, 18], the study directly addresses these inequities by (i) introducing a co-design process for in

teachers to engage students with diverse learning needs with the use of AI; (ii) helping teachers understand how to promote culturally relevant, interdisciplinary learning experiences for all students in inclusive classrooms. And finally, the study provides a process for teachers to act on the project for their peers by giving teachers the agency to develop the plans for the school community. The study contributes to a better understanding of utilizing AI and a deeper understanding of inclusive education that moves beyond "inclusion" and towards equity-centered education for all students.

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