

Language Impacts of Early Child Education

Miss Gabriela Maria Morales, University of South Carolina Beaufort

I am a senior at the University of South Carolina Beaufort where I studied computer science. I am a first generation student to study in the United States in my family. This summer I had the pleasure to work with a local boys and girls club early education facility where I discovered how important a cultural impact can have on a child's development.

Ronald Erdei, University of South Carolina

Dr. Ronald Erdei is an Assistant Professor of Computer Science at the University of South Carolina Beaufort. A graduate of Purdue University (PhD 2016), his research focuses primarily on reducing barriers to the learning process in college students. Topics of interest include computer science pedagogy, collaborative learning in college students, and human-centered design. Of particular interest are the development and application of instructional practices that provide benefits secondary to learning (i.e., in addition to learning), such as those that facilitate in learners increased self-efficacy, increased retention/graduation rate, increased matriculation into the workforce, and/or development of professional identity.

Mr. William Rigoberto Mercado, University of South Carolina

I am an undergraduate at the University of South Carolina Beaufort (USCB) studying Computer Science, soon to graduate in December of 2021. I am a first generation college student within my family in the United States.

I take an interest in learning how technological solutions are utilized and the effectiveness of these solutions. Additionally, I want to be able to understand real-world problems and potential solutions to assess these issues.

During the summer of 2021, I took the opportunity to work with an early learning organization, The Children's Center (TCC), in South Carolina. Continuing the project started by a peer at USCB and working with another peer the summer of 2021, I learned the importance of working with real world problems and the iterative design process.

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Abstract:

This student paper presents our assistance to a community partner that is continually seeking to improve its ability to serve its increasingly diverse community. More specifically, this poster focuses on our assistance to a provider of early education in our community that increased the efficacy of communication with its ESL (English as a second language) stakeholders.

Our community partner, The Children's Center (TCC) is a small, nonprofit organization of early childhood education and affordable quality childcare for working families in our community [1]. TCC is in Hilton Head Island, an affluent area that attracts many wealthy tourists. The community possesses a vast divide in wealth, as many members of the community work in low paying service, sales, and clerical professions [2] and many are in the opposite end of the wealth divide. Consequently, many community members are unable to afford the traditionally high cost of early childhood education and childcare – it is these community members that are directly served by TCC. TCC employs a sliding tuition scale based on parental income, enabling access to early childhood education to those in our community who would otherwise be unable to afford it. Families served by TCC are unsurprisingly racially and ethnically diverse: approximately 50% are Black, Hispanic, or Indigenous. These demographics align with the United States Census Bureau's 2019 report on Income and Poverty in the United States [3].

In 2017, South Carolina codified a set of early learning standards and developmental indicators (SC-ELS) to describe learning and set expectations for children from birth through kindergarten entry [5]. These early learning practices range from a variety of topics from cognitive development, emotional development, language development and much more. This wide range of variables to measure makes data collection and data entry cumbersome.

Worse, this complexity also makes data analysis, data interpretation, and result dissemination (i.e., information sharing) nearly impossible for small non-profit early education providers which traditionally lack sufficient resources to build or purchase IT tools to facilitate these processes. This project can be described in two phases. However, my work begins in Phase 2 where I focus on communication of results to teachers, parents, and other caregivers. Shared understanding is an important step to further a child's development; unfortunately, it is often hindered by divisions in language.

In response, I modify the language in progress reports shared with parents of TCC's multicultural students. My initial investigation into the impact of these changes was promising and is included in the poster. My work is ongoing though, and I will be further exploring the impact of these changes and others like them as it is critical for schools to modify their teaching approaches to benefit all students.

Introduction

Every field from florist to veterinarian is now technologically enabled. Consequently, those in the computing and engineering communities have the privilege of working in any corner of the world. This paper discusses the work currently in progress by which a small team of undergraduate students majoring in computer science are enjoying the privilege to impact the world's newest minds, those of children under the age of five.

The Children Center (TCC) in South Carolina is a non-profit early learning education center. They teach children ages zero to five in accordance with South Carolina's early learning standards (SC-ELS). These early standards focus on crafting a child's physical, cognitive, social, and emotional development. What children learn between birth and the time they start kindergarten lays the foundation for their learning and development for years to come. TCC is a growing community for Hilton Head families to offer children the best advantages to prepare them for their lives.

TCC strives to give children their best chance for success, therefore the center employs a sliding tuition scale based on parental income, enabling access to early childhood education to those in our community who would otherwise be unable to afford it. This is the only education center in the area that employs this type of tuition scale. The disproportionate allocation of wealth in the United States allows some schools to be better funded than others and allows parents with high socioeconomic status to send their children to better public or private schools [6]. Considering this, the work that TCC is doing is remarkable. TCC gives children of lower economic status a chance to level the playing field. Like all other schools and universities across the country, TCC student body population is diversifying rapidly. Just over 50% of their students are either Black, Hispanic, or Indigenous.

To continue to give kids of lower socioeconomic class equal learning opportunities that more fortunate kids have, TCC understands the disadvantages that face these kids and builds a program to help break the systematic barriers and provide high quality education. The first five years of life is where essential development is at its most critical. Knowing this, the question becomes: How can engineers in the computer science field use their skills to help improve this type of development for society's most influential members and why is it important?

Literature Review

The Children's Center strives to provide the best early childhood education to those enrolled in their program. This is an important topic because preschool-aged children experience profound biological brain development and achieve 90 percent of their adult brain volume by age 6 [6]. Outside factors such as racial diversity and socioeconomic levels also affect a child's development. TCC understands these influences and for these reasons is why we value this community partner so highly.

Childhood development is an important determinant of health over a person's lifetime.[8] Early developmental opportunities can provide a foundation for children's academic success, health, and general well-being.[6]

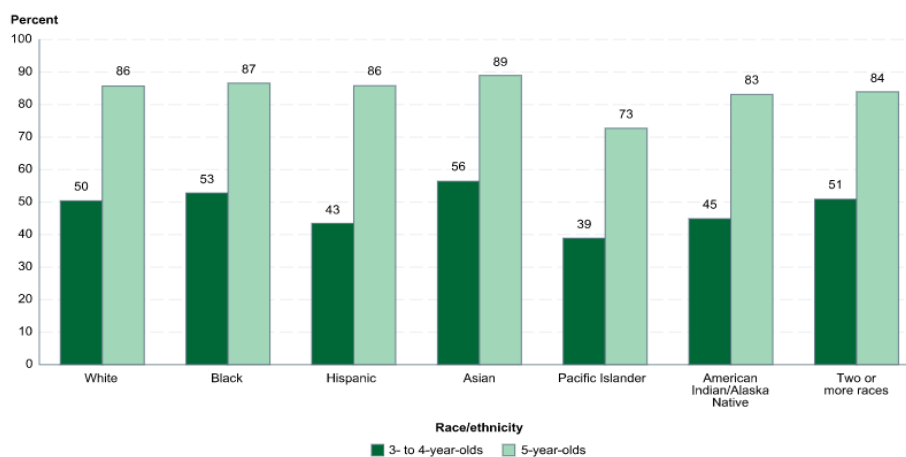
- Early childhood education benefit estimates, both short- and long-term, included the following major components [6]:
 - Increases in maternal employment and income.
 - Reductions in crime, welfare dependency, and child abuse and neglect.
 - Savings from reduced grade retention.
 - Savings in health care costs.
 - Savings in remedial education and childcare costs.
 - Improvement in health outcomes associated with education.
 - Earnings gains associated with high school graduation.
 - Better jobs and higher earnings throughout employment years for children participating in these programs.

Early childhood education interventions improve children’s development and have extreme long-term benefits as well. The way a child is brought up can determine what they achieve in their lives and with further exploration, can be led to programs specially devised for early engineering education. However, cultural diversity and socioeconomic levels also plays a huge role in affecting early education development. To have specialized programs for engineering education, barriers like diversity need to be broken as to not effect a child’s upbringing. TCC is also focused on exploring cultural and socioeconomical diversity.

Racially diverse schools are associated with higher student achievement than high-minority schools “Diversity supports the development of important cognitive skills in young children; in the long run, it can foster far greater social understanding and social equity” [9]. They can also reduce the prejudices and social isolation of children by race and class, as well as promote cross cultural relationships that have long- term benefits such as greater social capital, employment opportunities, and comfort in multi-racial settings.” [9] Cultural diversity for 4-to-5-year-old children in 2019 is depicted in Figure 1 [7].

Figure 1: Average classroom diversity in U.S. in 2019 [7]

Figure 2. Percentage of 3- to 4-year-olds and 5-year-olds enrolled in school, by race/ethnicity: 2019



As the graph shows, diversity between all races within the U.S as of 2019 is equal which is why learning how to teach a well-diversified classroom is now a priority. Teachers who can teach a well-diversified class have shown that their students were more likely to be on-task and less

likely to be off-task. Teachers who are not as aware of how to teach a well-diversified class have shown that their students were significantly more likely to be distracted and/or not engaging in activity/transitioning [8].

The socioeconomic status of a child is something that they are born into. There is much research done into how the socioeconomic status, SES, of a person is affected by in their later years of life, but little research done on how it affects a person in their beginning years. The SES of parents is what guides the child into what schools they attend. Schools of lower SES “tend to have less advanced coursework, less curricular emphasis on reasoning in addition to basic skills, less homework, lower teacher expectations, fewer teachers with experience relevant to their subject area, and less positive disciplinary climate. Lower SES schools are also more likely to have parents of lower levels of education, higher rates of mental health issues, and highly stressful lives that may hinder participation in their children’s education at home and school” [10]. To summarize, children of lower SES go tend to go to a lower quality education program and parents fall victim to hardships which does not allow them time to help properly develop their children.

For young children to develop properly, a rich learning environment is crucial. A learning environment is defined as the conditions that affect the behavior and development of someone. A baby or toddler is a sponge for new information, their learning environment is wherever they are. At an early age, a child benefits most from a well-organized, planned, safe, dependable, and flexible environment. TCC uses the SC-ELS as a guideline for how they plan their classes, but the education continues at home. Increasing communication between home and school is where a child can benefit from a fully rounded education, and this is where using IT tools can be used as a platform to assist families better understand their child’s development in the TCC program.

TCC understands the importance of early education and how outside factors like cultural diversity and socioeconomic status can affect a child’s developmental outcomes. By providing a sliding scale tuition-based option to parents of lower SES, TCC has more diversity in each class. Being aware of these outside factors, TCC is a place where administration is trying to break the systemic barriers to provide high quality education to all kids. A major focus on how to help TCC break these barriers is to create a community with rich communication with all parties involved.

Our Work

Communication is imperative between every person involve in this education center. Administration is responsible for the design of the program. They communicate with stakeholders what the purpose of their education program is and why it is valuable. Parents can be considered stakeholders since they are invested and concerned in their child’s education. Administration communicates with teachers to implement their program. Teachers and parents are the closest in communication with child.

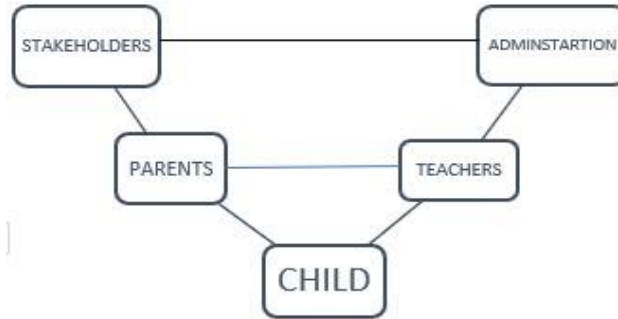


Figure 2: TCC Community Members

To understand the work our team has done with TCC, first understand what their initial processes are before our partnering. Using the SC-ESL guidelines TCC created formatted Microsoft Excel spreadsheets to keep track of all developmental factors from infancy to age 5. Teachers use these spreadsheets to keep track of growth and development daily. Administration collects the printed reports at the end of each day and stores them in a folder, one folder for each child. Using this method of manually storing each procedure is time consuming and challenging for data analysis with such a large variety of data.

To solve this problem, our team designed and implemented a software application to help TCC collect, store, and retrieve student information previously kept on the Excel spreadsheets. While implementing this software, we created space for continual improvement to manage communication between all community members of TCC. Two major changes were made at this stage.

First change implemented was the change in language reports. Previously, teachers described children’s progress as completed (C), progressing(P), needs work/ not applicable (N). Now teachers state their progress as either needs work (N), developed (D) or mastered (M). Figure 3 depicts a partial progress report, developed during an early iteration of the application.

Goal	Description	0	1	2	3

	May 2021 Progress Report				
	Ladybugs, 4/5 Year Olds				
	Detail				
	M = Mastered, D = Developing, N = Needs work, / = Not applicable				
	Bellamy Andon	Aug	Nov	Feb	May
	Approaches to Learning and Play (APL)				
APL 4/5-01	Shows interest in more topics and new skills, and wants to share them (verbally and non-verbally) with others.		M	M	M
APL 4/5-02	Shows interest in mastering new skills (writing name, riding bike, etc.)		M	M	M
APL 4/5-03	Asks questions about things that interest them, including about future events.		M	M	M
APL 4/5-04	Uses more complex language to share ideas and influence others during play.		M	M	M
APL 4/5-05	Makes up stories, songs or dances for fun during play. Invents new games.		M	M	M
APL 4/5-06	Shows willingness to try new things.		M	M	M
APL 4/5-07	Solves problems with materials at hand, then explains how they did it.		D	M	M
APL 4/5-08	Applies learning to new situation, shows more independence and purpose when making choices. ("Let's make a rocket ship. We need blocks.")		M	M	M
APL 4/5-09	Maintains attention and focus, even after interruption.		D	M	M
APL 4/5-10	Persists in tasks that are challenging, seeks help or tries different ways to complete the task, if needed.		D	M	M
	Emotional and Social Development (ESD)				
ESD 4/5-01	Describes self with more detail and accuracy ("My eyes are brown", "I am tall").		M	M	M
ESD 4/5-02	Expresses positive feelings about self (tell others about themselves, "I can run fast", believes can do many things, etc.)		M	M	M

Figure 3: Partial Progress Report

M= Mastered

D= Developing

The second major change was establishing that all reports made could be printed in English or Spanish. This is for the benefit of a parent who is more comfortable assessing reports in Spanish.

The team's effort is highly prioritized on strengthening the communication with parents and teachers. Consequently, development efforts have broadened to include refining the language used:

- to describe student progress (i.e., the grade or rating)
- to convey current student developmental status via student progress reports offered in both English and Spanish language

Gap in Knowledge

To develop this application, the team followed the agile methodology depicted in Figure 4, focusing on multiple iterative incremental development and deployment cycles.

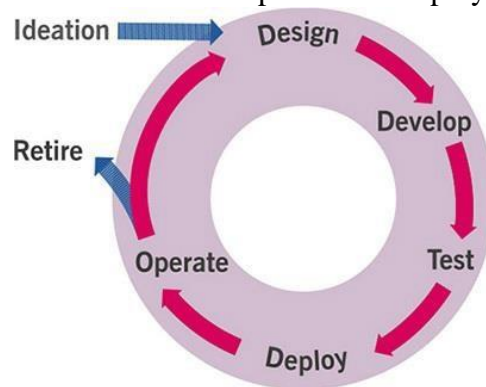


Figure 4: ITIL Software Lifecycle

To facilitate better understanding of learning objectives, as well as better understanding of student progress toward mastery of the learning objectives, the language used in the progress reports was updated in the most recent iteration of the application. However, these alterations to language had been crafted by administrators and application developers. It had yet to be determined if these changes would facilitate better understanding and communication among and between teachers and parents.

Research Questions

Our research questions focus on the impact of our language change and were developed using guidelines from Creswell's *Qualitative Inquiry & Research Design: Choosing Among Five Approaches* [12].

Central question:

What is the impact of our language changes on the shared understanding of student progress toward the SC-ELS learning objectives?

Sub-questions:

- What is the impact of our language changes on the understanding of the SC-ELS learning objectives among teachers?
- What is the impact of our language changes on the understanding of the SC-ELS learning objectives among parents?
- What is the impact of our language changes on the ability of teachers to communicate student progress toward SC-ELS learning objectives to parents?

Methodology

To assess whether the changes to language increased shared understanding of learning objectives and student progress toward those learning objectives, several small focus groups (3-5 participants) will be held. The initial focus group participants will be teachers from TCC. Table 1 describes the questions and tentative timeline for the focus groups.

	Question	Investigates
1	Would you describe your teaching background?	opener
2	In your own words, what are the South Carolina Early Learning Standards (SC-ELS)? And what is their purpose?	opener
3	If you are comfortable sharing, do you believe the SCELS are useful?	opener
4a	How comfortable do you believe the parents of your students are with the SC-ELS?	opener
4b	Do you believe the parents (of your students) think they are useful? Meaningful?	opener
5	How comfortable are you with the language used in/phrasing of the SC-ELS?	opener
6	Do you believe the parents (of your students) find the language used in/phrasing of the SC-ELS easy to understand?	RQ
7a	How have the report cards which TCC generates for you changed the way you communicate with parents?	RQ
7b	Have the recent changes in language on the progress reports improved your communication with parents?	RQ
8	Can you describe changes which you have made to your teaching, your classroom, etc. due to your awareness of the SC-ELS's goals?	RQ
9	Side-by-side comparison of old & new language. Ask the participant to describe the meaning of each.	

Table 1: Focus Group Questions and Tentative Timeline (Teachers)

During the focus groups, participants will be audio taped. This data will subsequently be transcribed using Otter.ai software [13] and analyzed using card sort methodology commonly employed in User-Experience Design [14].

Tentative Results

At the time of this writing, one focus group has been conducted. We are withholding formal analysis of the data until collection is complete. However, anecdotally these are the initial impressions made on the researchers.

- All teachers have specifically stated the need to be extremely careful when talking to parents.
- Parents are aware of the SC-ELS because it is mentioned in orientation as guiding principles for how teachers will run their classrooms. However, the staff does not communicate with parents in those terms. Parents are not as concerned with the official learning standards.
- Parents can be quite sensitive to hearing about their children's progress especially if they are not developing in the manner as stated by the SC-ELS.
- All teachers have the attitude that each child develops at their own pace, and they emphasize this when communicating with parents.

Teachers from the 1- to 2-year-old age group and the 3- to 4-year-old age group both emphasize their classroom on teaching social development. They are mostly concerned about whether children can have a good relationship with each other. They educate the children on the importance of sharing and treating others with respect. At this stage in life, children begin to talk so these teachers start to define the different emotions so that children will communicate better. Since children have more control of themselves at this age, they fill out quarterly reports based on SC-ESL. Teachers also keep a daily report for each child that gets handed to administration. Refer to Figure 2 to see what a normal end of year report looks like for a single child.

Relating to changing children reports from English to Spanish, all teachers stated that most of the time they do not have an issue communicating to Spanish speaking parents or their children. When or if they do, they can usually find a translator nearby. Teachers in the classroom communicating with multi-lingual children encourage them to speak in their native tongue with the other native speaking children in the room. This encourages their language development and communication (LDC) goals in SC-ESL. They admit that some parents would enjoy reading about their child's progress in a language they are more familiar with, but these reports are not what is most important to them. A parent is more invested in what the teacher tells them face-to-face rather than reading reports.

Overall, teachers use the SC-ESL principles as a guideline to how they run their class. They are a lot closer to the children personally since they are one of their primary care takers. They admitted that the change in world plays in the reports that they fill out daily make a positive difference.

Discussion

As ask earlier, how can engineers in the computer science field use their skills to help improve this type of development for society's most influential members, and why is it important?

Our team used programs such as SSMS (SQL Server Management Studios), Visual Studios, and Microsoft Azure to help consolidate data and create software that will improve the way TCC collects future data. This in turn helps the facility run more efficiently, which will produce better outcomes for the students. This may not benefit computer engineers directly, but it is a great way to give back to the community. However, there is still a way information specifically from SC-ESL can help the computer engineering field.

From the age of infancy to just before kindergarten, children absorb information like a sponge. The skills needed to become a computer engineer include heavy communication skills and analytical/critical thinking skills. These skills needed to become computer engineers can be taught as early as The Children Center teachers fundamental motor skills to infants. Focusing children on LDC (language development and communication), MTE (mathematical thinking and expression), and CD (cognitive development) can tune a child from an early age to have the mind of a computer engineer. Programs can be developed in schools and early childcare facilities like TCC, for children to have like-minded computer-focused skills. These programs would be for long term benefits for the computer engineering field.

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