The Sherman Center for Early Learning in Urban Communities
Final Report

Grantee's Institution/Organization: University of Maryland, Baltimore County

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Program Name: A Comparison of Simultaneous and Sequential Bilingualism in Children with Autism Spectrum Disorder

Grant Amount: $50,000.00 **Amount Received:** $50,000

Period that this report covers: 08/01/23-10/31/25

Organization, Design, Methodology, and Outcomes

Please identify all the members of the research team and the role each played in the study. Similarly, please identify any universities, medical centers, schools, or other facilities involved in the research and briefly describe their collaborative or supporting roles.

Personnel	Role	Involvement	Institution
Mirela Cengher	PI	Designed and oversaw the project, analyzed data, edited/wrote manuscripts, prepared presentations	University of Maryland, Baltimore County (UMBC)
Shuyan Sun	Co-PI	Statistical analyses—designed the research methods and analyzed the data	UMBC
Xuehua Zhao	Graduate Student	Collected and analyzed the data, wrote parts of manuscripts for publication, prepared presentations	UMBC
Tianjiao Li	Graduate Student	Collected and analyzed the data, wrote parts of manuscripts for publication, prepared presentations	UMBC
Ann Jeanette Santos	Graduate Student	Collected and analyzed the data, wrote parts of manuscripts for publication, prepared presentations	UMBC
Mariele Diniz Cortez	Collaborator	Consulted on the design of the procedures	Universidade Federal de São Carlos

Briefly state the primary research question(s), summarize the methodology, and describe the actual outcomes.

Many children with Autism Spectrum Disorder (ASD) have diverse cultural and linguistic backgrounds. Research shows that bilingualism does not lead to language delays in children with ASD; however, no research evaluated the optimal procedures for teaching two languages. Our first aim was to compare the acquisition of a small vocabulary when (a) teaching two languages simultaneously, (b) teaching two languages sequentially, and (c) teaching one language only (control). In general, all procedures were effective. Overall, we found that children with ASD learned two languages simultaneously more efficiently than sequentially. We also found that learning one language only was more efficient than learning two languages. Our second aim was to identify the effects of the aforementioned teaching conditions on the maintenance of a small vocabulary in two languages. We found that the longer the duration of the training, the better the maintenance. We also found that participants demonstrated better maintenance when learning two languages simultaneously. Our third aim was to evaluate the effects of the aforementioned conditions on the translation of a small vocabulary in the two languages. We found that children demonstrated better translations when learning two languages simultaneously; however, in general,

children did not demonstrate high accuracy of translations. In total, we collected data for 19 applications (i.e., times that we ran participants through the protocol) with 11 participants.

In what way did the project vary from your initial plan? Describe how/why and discuss to what degree the changes affected your intended methodology.

I met with the director and staff members of a public school in Baltimore County that served children with developmental disabilities. The director and staff members were very supportive of this project. However, my IRB protocol was declined. When I reached out to the school director to ask for her support in appealing the IRB decision, she declined. As such, after consulting with Dr. Mata-McMahon, I reached out to other research partners and eventually conducted the research at Verbal Beginnings, a private preschool for children with autism spectrum disorder.

With the first pilot cohort of 3 participants, we learned that (a) it takes significantly longer than 6 months, as we initially predicted, to run each participant through the protocol, and (b) it is necessary that children have a good repertoire of code-switching between languages to successfully learn two languages.

The PI, Dr. Mirela Cengher, met weekly with the doctoral students conducting the study to monitor ongoing progress. The PI met with the consultants (Dr. Mariele Diniz Cortez) every other month to discuss progress as well. During these meetings, based on the outcomes detailed above, we decided to make the following modifications for the second cohort of participants:

a. **To increase the efficiency of the protocol**: To expedite the timeline to complete the protocol, we also conducted within-subject replications (comparisons) with some participants. The within-subject replications involved running participants through the protocol multiple times consecutively (i.e., teaching a different set of expressive labels each time). This modification increased the efficiency of language acquisition (i.e., with each within-subject replication, participants learned more efficiently), enabling us to collect more data in less time. As a result, we collected data with 11 participants instead of the initial number proposed ($N = 12$). However, with these 11 participants, we completed a higher number of comparisons as initially proposed ($N = 19$).
b. **To increase the chances that participants will successfully run through the protocol**: we changed the inclusion criteria to make them more stringent concerning code-switching between languages. To screen for this ability, we are requiring that potential participants score at Level 2 or higher on some relevant subscales of the VB-MAPP assessment.

Compare the outcomes predicted in your original proposal to the actual outcomes, identify any variances, and discuss the most significant findings (Refer to your Interim Report as necessary).

Our main hypotheses (aims) were confirmed, as described above.

Describe any unexpected outcomes either favorable or unfavorable.

One unexpected finding was that the differences between monolingual and bilingual instruction dissipated with repeated exposure (i.e., within-subject replications; Zhao & Cengher, accepted). These findings suggest that the well-documented learning differences between monolingual and bilingual children can be remedied with programmed, systematic instruction. We are currently pursuing this line of research, with one manuscript accepted for publication.

Another unexpected finding was that some children seemed to be more developmentally ready to learn two languages than others; we attributed these differences to their ability to code-switch between languages and we included this ability as an inclusion criterion for the current study. Currently, we are beginning to pilot a novel study that evaluates prerequisites for learning two languages. This new study is also the topic of grant proposals that I am currently working on.

To what extent does this research advance the state of our knowledge regarding autism intervention?

This study advances our knowledge regarding autism intervention in several ways. First, it demonstrates that simultaneous bilingualism is more effective and efficient than sequential bilingualism, even for children with ASD with documented language delays (i.e., a population with whom this research question was not answered before). Second, we found that monolingual instruction is more effective and efficient than bilingual instruction—which is aligned with the well-documented gap in learning between monolingual and bilingual children (Reardon & Galindo, 2006; U.S. Department of Education, 2006).

If you were to conduct this study again, what modifications, if any, would you make to your design to enhance the outcomes and strengthen the results?

We would focus on increasing the efficiency of running participants through the protocol. In the section above, we outline changes that we've made after our initial pilot experiment. In subsequent applications with additional participants, these changes were demonstrated to increase the efficiency of the protocol. In future studies, we would retain these changes.

Practical Findings

Describe the most relevant finding(s) of this study for (1) a person with autism, (2) a parent of a person with autism, and (3) a teacher or caregiver.

These outcomes from this pilot study provided a framework of procedures that parents and clinicians could use to better develop teaching procedures for children with ASD from diverse cultural and linguistic backgrounds. For example, clinicians could begin teaching children from diverse cultural and linguistic households English from the first day of school. Furthermore, if the resources allow (e.g., teachers who are familiar with the children's native language), clinicians could teach new vocabulary in both languages concurrently. Overall, this general framework of teaching children from bilingual households can maximize the efficiency of instruction, which is crucial for bridging the gap between the learning curve of children with ASD and their neurotypical peers.

Most children with ASD receive individualized or small-group instructions, where they are presented with multiple opportunities to respond while they acquire new skills similar to the procedures employed in this study (National Autism Center, 2015). An assessment-based pilot study such as the one we propose does not just provide information about the optimal procedure(s) for children with ASD but also provides procedural information on how to arrange teaching to maximize learning. For example, clinicians could simply replicate our most efficient procedure (i.e., simultaneous bilingualism) to teach new vocabulary consisting of new labels, translations, or other forms of language (e.g., requests).

The findings from this pilot study can also inform decisions that caregivers need to make early on concerning exposing their children to different languages. For example, since simultaneous bilingualism is more efficient, caregivers who speak a language other than English at home may be encouraged to take their children to English-speaking daycares as soon as possible to ensure that both languages are acquired concurrently. If caregivers do not have the resources to take their children to daycares, they could be encouraged to take their children to playgrounds where other children speak English or to expose their children to games and videos in English rather than in their native language.

Finally, identifying the optimal order of learning two languages may have benefits beyond the acquisition of the vocabulary itself. Specifically, research shows that neurotypical bilingual children have better cognitive development as compared to monolingual children (Bialystok 2001; Bialystok & Craik, 2010). Even though these outcomes have yet to be replicated with children with ASD, all research examining bilingualism in the two populations yielded similar outcomes, which suggests that children, in general, acquire language in the same way. Another important reason to teach two languages to children with diverse cultural and linguistic backgrounds is that mastery of their native language will allow them to connect with their caregivers, who are often not proficient speakers of English. This, in turn, may increase the children and their caregivers' sense of cultural identity and belongingness (Beauchamp & MacLeod, 2017; Fillmore, 1991; Hampton et al., 2017; Howard et al., 2020; Yu, 2016).

Next Steps/Implications for Future Research

Do you intend to submit a report on this study to any professional journals? If so, which publications?

We already submitted one manuscript for publication (accepted), and three others are in preparation. In addition, we presented (including one invited keynote) this work 10 times at national and international conferences. Finally, we submitted grant applications that stemmed from the pilot data funded by the Sherman Center. Please see below for more details.

Peer-reviewed Publications

Note: Sherman Center for Early Learning in Urban Communities's funding was acknowledged in each of these manuscripts and presentations.

Zhao, X., & Cengher, M. (accepted). Learning to learn: a comparison of monolingual and bilingual instruction. *Behavior Analysis in Practice.*

Cengher, M., Zhao, X., Santos, A. J., Li, T., Sun, S., Cortez, M., & Miguel, C.F. (in preparation). *Bilingual instruction in children with Autism Spectrum Disorder.*

Zhao, X. & Cengher, M. (in preparation). *An evaluation of prerequsites for learning a bilingual repertoire.*

Santos, A. J., Cengher, M., & Zhao, X. (in preparation). *Teaching a bilingual repertoire using naturalistic teaching procedures.*

Peer-reviewed Presentations

1. Zhao, X. & Cengher, M. (November 2025). Learning to Learn: A Comparison of Monolingual and Bilingual Instruction. Talk presented at the 12th International Conference of ABAI, Lisbon, Portugal.
2. Cengher, M. (July 2025). *On Bilingualism: Why and How to Teach Multiple Languages to Children with Disabilities.* Keynote presentation to be presented at the 4th Annual Science in Behavior Analysis Conference. Rowan University, NJ.
3. Cengher, M. (March 2024). *Bilingualism in Children with Autism Spectrum Disorder.* Invited talk presented at the Verbal Behavior Conference, Austin, TX.
4. Cengher, M. (January 2024). *Teaching Foreign Languages to Children with Autism Spectrum Disorder.* Invited talk presented at Verbal Beginnings, Columbia, MD.
5. Cengher, M. (October 2023). *Bilingualism in Children with Autism Spectrum Disorder.* Invited talk presented at PennABA, Lancaster, PA.
6. Cengher M. (chair), Angulo, A., Miguel, C. F., Hanson, R., Zhao, X.*, Li, T.*, Cortez, M. (May 2024). *Optimal Procedures to Learn a Foreign Language.* Symposium presented at the annual conference of the ABAI, Philadelphia, PA.
7. Cengher, M. (chair), Holth, P. (discussant), Clayborne, J.*, Li, T.*, Shawler, L., & DeSouza, A. (September 2022) *Beyond Direct Instruction: Procedures Aimed to Support Emergent Responding and Observational Learning in Children with Autism Spectrum Disorder.* Symposium presented at the international conference of ABAI, Dublin, Ireland.
8. Cengher, M. (June 2024). *On Bilingualism: Why and How to Teach Multiple Languages to Children with Disabilities.* Talk presented at the Sherman Center Research Conference, Baltimore County, MD.
9. Li, T., Cengher, M., Ahmed, I., & Zhao, X. (May 2024). *A Comparison of Teaching Two Foreign Languages Simultaneously and Sequentially to Young Adults.* Talk presented at the annual conference of the ABAI, Philadelphia, PA.
10. Zhao, X., Cengher, M., Li, T. (May 2024). *Identifying the Optimal Procedures to Teach Two Languages to Children with Autism Spectrum Disorder.* Talk presented at the annual conference of the ABAI, Philadelphia, PA.

Research Support and/or Fellowships

2024	National Science Foundation, CAREER Award (Principal Investigator; 95% effort, $679,738; not funded)
2023	Universidade Federal de São Carlos, International Visiting Professor (Principal Investigator, 90% effort, $ 3,000; funded)

What do the findings of this study suggest in terms of future research? Briefly describe the rationale for continued funding, expansion, replication, or termination.

If, in your professional judgment, additional research is indicated, what level of funding is required, and whom do you plan to approach for funding?

The funding from the Sherman Center was foundational for establishing this line of research. Since 2023, I have secured two additional sources of funding for this line of research (described above). I have and will continue to seek additional funding from the National Science Foundation and the National Institute of Health. I am seeking a higher level of funding for these new projects (e.g., my NSF proposal had a budget of approx. $ 650,000).