Engaging Undergraduate Students in Child Language Research

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Abstract

To better prepare the professionals and scholars of tomorrow in the field of communication sciences and disorders (CSD), a research project in which undergraduate students collected and analyzed language samples of child-parent dyads is presented. Student researchers gained broad and discipline-specific inquiry skills related to the ethical conduct of research, the literature review process, data collection using language assessment techniques, language sample analysis, and research dissemination. Undergraduate students majoring in CSD developed clinical research knowledge, skills, and dispositions necessary for future graduate level study and professional employment. In addition to the benefits of student growth and development, language samples collected through this project are helping to answer research questions regarding communicative turn-taking opportunities within the everyday routines of young children, the effects of turn-taking interactions on language development, and the construct validity of language sampling analysis techniques.

Undergraduate Preparation

Undergraduate programs in Communication Sciences and Disorders (CSD) introduce students to the field of speech-language pathology, develop students' knowledge specific to the processes involved in communication, and acquaint students to the diagnostic and intervention principles used to support individuals with communication disorders. Due to the pre-professional nature of the degree, the undergraduate curriculum provides the foundation in speech, language, and hearing processes necessary to prepare students for graduate study. Undergraduate CSD courses are generally rich in knowledge-based learning within classroom contexts. However, support is building for greater student involvement in clinical and research experiences (Friberg, Folkins, & Visconti, 2013). Opportunities to engage in practical activities and applied research allow students to transfer classroom content to real-life situations involving individuals with and without communication disorders.

Building Student Interest in Research

To better prepare the CSD scholars and professionals of tomorrow, we must build their interest in research when they first enter the major. As reasoned by Hagstrom, Baker, and Agan (2009), active participation in scientific inquiry builds future researchers because research is more likely to become a professional habit if it is fostered early in the undergraduate years. By engaging undergraduates in research today, we can help ensure the future scientific base of our

field, prepare students to utilize evidence-based practice information during Master's-level and professional clinical experiences, and potentially encourage more professionals to return to academia for doctoral work and university careers (Friberg, Folkins, Harten, & Pershey, 2013; Hagstrom et al., 2009; Mueller & Lisko, 2003).

The American Speech-Language-Hearing Association (ASHA) recognizes the value of undergraduate research as a means to increase both interest in scientific inquiry and the pool of students electing to pursue doctoral education (Hagstrom et al., 2009). Several ASHA programs are designed to support undergraduate engagement in research, including PROmoting the next GENeration of Researchers (PROGENY), the Students Preparing for Academic and Research Careers (SPARC) Award, and the Student Research Travel Award (Friberg, Folkins, Harten & Pershey, 2013). In addition, undergraduate engagement in research is commonly discussed within universities as a way to enhance student learning and preparation for graduate studies. The Council for Undergraduate Research (CUR) is a national organization comprising individual and institutional members representing over 900 colleges and universities (Council on Undergraduate Research, 2014). The mission of CUR is to support and promote high-quality collaborative research and scholarship opportunities for faculty and students at all institutions serving undergraduate students. Growing interest in undergraduate research is understandable given its propensity to increase student learning opportunities beyond the classroom. Through research experiences, faculty members help students develop and test their ideas and encourage them to share their scholarly efforts through presentations and papers.

Purpose

The undergraduate research project presented in this article aimed to prepare students majoring in CSD for scientific inquiry in the area of child language development. In accord with program curriculum standards, students complete courses related to linguistic development, child development and psychology, communication disorders, cultural variations, and diagnostics/assessment. Research on instruction and andragogy highlights the importance of transferring knowledge to skill through the actual application of content learned in the classroom to real world situations (Knowles, Holton, & Swanson, 2005). Thus, faculty at the project university, including the CSD Department Head and the instructor for the course on normal language acquisition, developed an undergraduate research agenda to:

a. Develop students' knowledge of discipline-specific inquiry skills,

b. Promote the application of such inquiry skills to answer research questions, and

c. Teach students how to present research results in professional and academic forums and why it is important.

The purpose of this paper is to share methods for engaging undergraduate students in research related to the CSD field, particularly the area of child language research.

Methodology

Participants

Each fall semester at the project university, junior level undergraduates majoring in CSD enroll in a course on normal language acquisition. When this project was implemented, 68 undergraduate students enrolled in and completed the course, which was offered in two sections (36 students in Section A and 32 in Section B). Students completed the undergraduate research project in one semester with the support of the course professor/project director, a graduate research assistant, and an undergraduate research assistant.

Training Mechanisms to Foster Knowledge and Skill Acquisition

The course on language development provided students with an initial study of language acquisition by focusing on the sequence and process of typical communication development in children. Topics included theories of language development, the sequential acquisition of the major components of language, variables affecting language acquisition, cultural variations, and the role of families in child development. Whereas content-based learning sets a foundation for student knowledge, a richer experience of critical thinking and clinical application was desired for the undergraduates. Thus, to better prepare these scholars of tomorrow, a research project was designed to provide practical experiences and engagement in research. Specifically, students participated in ethical conduct in research training, contributed to the literature review process, collected audio recordings of parent-child interaction, and analyzed the recordings using computer technology and traditional language sample analysis procedures.

Ethical conduct in research training was completed to comply with Institutional Review Board (IRB) policies and ensure that student researchers were adequately prepared to interact with young children and their families in an ethical and professional manner. Training also aimed to boost the confidence of student researchers as they embarked on the process of sharing research information and documentation with potential participants. Training consisted of in-class discussion, an overview of project consent documents, and completion of a course on *The Protection of Human Research Subjects* through the Collaborative Institutional Training Initiative (CITI) online training program (Collaborative Institutional Training Initiative, 2011).

A search of relevant literature is an appropriate starting point, so each student researcher participated in the literature review process by identifying an appropriate research-based journal article and submitting an annotation of such article. Students were instructed to locate articles on the topics of child development, parent-child interaction, and language sample collection and analysis. Additional parameters were that the articles be peer-reviewed, published since 1990, and at least 8 pages in length. Although most students selected more recent articles, the publishing date of 1990 was selected as the cut-off to allow students the opportunity to see the progression of language sampling and analysis techniques over time. To orient students to the literature review process, a university reference librarian provided instruction on locating research articles, following American Psychological Association (APA) citation rules, and writing article annotations. Upon identification of an appropriate article, each student was instructed to write an annotation of his/her selected article. The annotation included two paragraphs: An article summary paragraph and a reflection paragraph focusing on the article's contributions to clinical practice, research, and personal knowledge. The annotations were then collectively organized into an annotated bibliography.

After completing ethical conduct in research training and the literature review process, the students collected and analyzed language samples of young children participating in daily routines with a parent. Specifically, the students were asked to work in pairs to complete the following tasks:

a. identify a family with a child between the ages of 2 and 4 years and attain their written consent to participation in language sampling research,

b. collect a language sample of parent-child interaction during typical family routines,

c. analyze the data using traditional language sampling techniques, and

d. compare part of their analysis to a computer-generated analysis of the same language sample.

Language sampling, a practice in which a child's productive language is recorded, transcribed, and analyzed (Retherford, 2000), is an integral component of the assessment process with young children (Paul & Norbury, 2012). A language sample collected in the child's natural communicative context provides an excellent measure of expressive language ability as it can be

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used to determine a child's phonological repertoire, use of vocabulary, grammatical knowledge, and pragmatic skills (Tager-Flusberg et al., 2009). Language sample analysis was selected for the undergraduate project because it is ripe for use in language development research and students need multiple experiences practicing the techniques involved.

The project director and supporting faculty provided classroom and small group instruction and coaching to the students to prepare them for the data collection and analysis experience. The *Guide to Analysis of Language Transcripts, 3rd edition* by K. S. Retherford (2000) was used as the primary teaching resource to facilitate accurate, effective, and efficient data analysis. Research protocols and training materials, including examples of language transcripts, were provided to students in class and on the course website. Such materials were also placed in a training binder located in the language sample lab.

Once students entered the data collection phase of the project, research assistants were available to distribute recording equipment and upload language sample data. An undergraduate student assistant was employed for 10 hours per week and a graduate assistant for 20 hours per week. In addition to logistical support, the student research assistants engaged in scholarly activities alongside project faculty to conduct data analyses and prepare research findings for dissemination within academic and professional communities.

Participation in Language Sampling Research

Language sample collection. The 68 undergraduate students worked in pairs to identify and recruit families for participation, which resulted in the collection of 34 parent-child language samples. Parent participants included 32 mothers and 2 fathers between the ages of 21 and 41. Child participants ranged from 24 to 48 months of age. As it is widely accepted that the most critical socio-communicative experiences for young children occur during interactions with their caregivers and family members (IDEA, 2004; McCollum & Hemmeter, 1997), language sample recordings occurred as child-parent dyads engaged in typical family routines within their homes or natural settings for at least 5 hours.

This project enabled student researchers to utilize innovative recording technology known as LENA. The Language Environment Analysis System (LENA) Pro and Research Version is a language monitoring and feedback system designed to provide information about the language environment of infants and toddlers. The LENA System consists of three main components: a Digital Language Processor (DLP) that records the language use of the child and communication partners, specially designed children's clothing with a pocket to hold the processor in place, and software that processes the recording from the DLP and provides computer-generated reports and graphs for data analysis (LENA Research Foundation, 2008).

Once families consented to research participation, undergraduate students met with them individually to provide logistical information about language sample collection. This meeting included a discussion on the operational features of the DLP, which is capable of recording up to 16 hours of continuous audio. Families were asked, if possible, to record a full day of typical interaction, but informed that a minimum of 5 hours were required for inclusion in the study. After families completed the recording process, students made follow-up visits to pick up the DLPs and LENA clothing items. Students then returned the materials to campus, whereby audio data on the DLP were transferred to a designated computer equipped with LENA software, and the clothing items were laundered for future use.

Language sample analyses. The LENA software analyzed the audio files based on the following measures:

a. Adult Word Count (AWC), which reported the total number of adult words spoken in range of the DLP,

b. Conversational Turns (CT), which provided estimates of the total number of adult-child alternations, and

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c. Child Vocalizations (CV), which reported continuous speech spoken by the child wearing the processor (Gilkerson & Richards, 2008).

Because the software also stored the uploaded audio files, student researchers were able to listen to and transcribe portions of the each language sample. Consistent with language sampling practices, students were asked to transcribe all language spoken by the target child and his/her communication partners until 100 permissible child utterances were transcribed. Permissible child utterances included those that were spontaneous, intelligible, and non-repetitious. If a child participant was found to communicate at a low rate or his/her communication was difficult to understand, students were required to record at least 30 minutes of interaction. Once samples were transcribed and checked for accuracy, students employed traditional language sample analysis techniques, such as the calculation of Mean Length of Utterance (MLU) and Type/Token Ratio (TTR). This process provided students with training and practice in computer-generated language sample analysis using LENA and traditional language sample analysis procedures. Further, it allowed them to compare the results of computer-generated and traditional analyses.

Language sample results. Students summarized the language sample results for each child participant by making a clinical judgment as to his or her developmental level. Such judgments were based on a combination of computer-generated and traditional analyses. Computer-generated results included rate of oral communication (i.e., the CV measure) and frequency of communicative turn-taking (i.e., the CT measure). Traditional results included the average number of morphemes used per transcribed utterance (i.e., MLU) and a measure of vocabulary density (i.e., TTR). Interpretation of results involved a comparison of individual performance to normative data found in journal articles and LENA Reports.

The study of group data is currently underway as language samples are collectively being used to answer research questions regarding communicative turn-taking opportunities within the everyday routines of young children, the effects of turn-taking interactions on language development, and the construct validity of language sampling analysis techniques. These are important questions for multiple disciplines, including speech-language pathology, early intervention, psychology, family and child science, child development, and early childhood education. The research questions or topics were originally developed by project faculty during the conceptualization of the undergraduate research project. However, as students became involved, some of them started to inquire about additional topics, such as differences in engagement with siblings based on age or the effects of background noise (e.g., television or radio) on language production.

Manuscripts and presentations based on group data are being developed by project faculty and students who expressed interest in research dissemination opportunities. To date, eight students have presented preliminary findings at local research symposia and at state and national conferences. Presentations have included the following:

a. using LENA to analyze lexical diversity in parent-child dyads,

b. examining parent-child interaction within everyday routines,

c. examining the relationship between young children's language and parental interaction,

d. correlations between expressive language ability and rate of communication in young children, and

e. computer-generated and traditional language sample analysis.

Results

Student Learning

Student learning outcomes for this project included: (a) demonstrating how to locate and evaluate scholarly sources, (b) demonstrating knowledge of research ethics, (c) collecting and

analyzing language samples of child-parent interaction, and (d) developing presentations to disseminate research findings. Table 1 provides the performance criteria and results for each of these outcomes. All four outcomes were satisfactorily met. Even so, data interpretation and dissemination of research findings continues to be an ongoing effort for students involved in the original study, as well as incoming students who are benefiting from an established data set available for analysis.

Table 1. Student Learning Outcomes

Learning Outcomes	Performance Criteria	Results
Students will demonstrate how to locate and evaluate scholarly sources.	Students will: (1) search key databases on language sampling, (2) obtain and read sources, and (3) collectively complete an annotated list of sources.	Criteria Met: A VSU Reference Librarian provided an in-class instructional session on the following topics: • locating research articles, • citing sources in APA format, and • writing an article annotation. Approximately 1 month into the semester, each student submitted a copy of a research-based article and an annotation of the article. Annotations included an article summary and an evaluative paragraph, in which the student critiqued the article and identified information learned by reading the article of choice.
Students will demonstrate knowledge of research ethics.	Students will present CITI training certificates and written consent attained from project participants prior to collecting data.	Criteria Met: All students in CSD 3070 completed the CITI Basic Course with the required percentage of accuracy (80% or higher). During multiple class sessions, the course instructor/project director reviewed ethical conduct in research principles and instructed students to share project information in a clear, easy-to-understand manner to potential research participants. Students were given copies of the project consent form and asked to return signed forms after thoroughly reviewing them with parent participants. During the data collection phase (September to November), students returned parent/child consent forms with the appropriate signatures.

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Learning Outcomes	Performance Criteria	Results
Students will collect and analyze language samples of child-parent interaction.	Students will: (1) obtain signed consent for participation from one family, (2) collect a 5+ hour language sample using a LENA DLP, (3) view computer-generated analysis of audio file, and (4) complete traditional language sample transcription and analyses.	Criteria Met: Sixty-eight undergraduate students participated in the research project. Working in pairs, they recruited 34 families to participate. While some audio recordings captured only 5 hours of parent-child interaction, many of the participating families recorded more than the required amount. Thus, the average sample length was 7.5 hours. These recordings resulted in an abundance of language/interaction data ready for analysis. A computer-generated analysis of language and turn-taking was conducted using LENA software. Student researchers also used the LENA system to (a) listen to and transcribe portions of each collected language sample and (b) analyze the sample based on traditional assessment measures, such as Mean Length of Utterance (MLU).
Students will develop presentations and disseminate research findings to local, state, and national audiences.	Following project completion, students will be recruited to make presentations at various research symposia and continuing education events held for (1) local audiences, (2) state audiences, and (3) national audiences.	**Criteria met:** (1) Undergraduate students presented posters based on LENA project data at the Valdosta State University 2013 and 2014 Undergraduate Research Symposia. One of the presentations won the Most Outstanding Poster award for the College of Education at the 2013 Symposium. In April of 2013, a pair of students presented LENA data at a professional development event hosted by the CSD Department at VSU. (2) Two posters related to this project were presented at the Georgia Speech-Language-Hearing Association (GSHA) State Conference in February 2013. (3) Three related posters were presented at the Annual ASHA Convention in November 2012. **Ongoing Effort:** Project faculty continue to guide students in data interpretation and the organization of presentations for future conferences.

In addition to the aforementioned outcomes, the course instructor/project director administered pre- and post-tests of student knowledge. The tests consisted of 12 multiple-choice questions divided into three research tasks/areas, including the literature review process, language sample procedures, and language sample analysis (see Figure 1). The pretest was conducted during the second week of the semester and the post-test, comprising the same 12 questions, occurred at the end of the semester.

Figure 1. Questions Asked of Student Researchers at Pre- and Post-Test.

Pre- and Post-test Questions

Literature Review

1. PsycINFO is a(n) _____.

    A.   Academic journal
    B.   Digital database
    C.   Peer-reviewed journal
    D.   Research publication
    E.   Periodical

2. Based on APA rules, what is missing from the following article citation?

Stein, A., Malmberg, L., Sylva, K., Barnes, J., & Leach, P. (2008). The influence of maternal depression, caregiving, and socioeconomic status in the post-natal year on children's language development. *Child: Care, Health & Development*, 603-612. doi:10.1111/j.1365-2214.2008.00837.x.

    A.   Country of origin
    B.   Volume number
    C.   Database reference
    D.   Author affiliation
    E.   Website from which the article was retrieved

3. A _____ is a list of sources (books, journals, websites, periodicals, etc.) one has used in researching a topic.

    A.   Literature review
    B.   Bibliography
    C.   Database
    D.   Catalogue
    E.   Reference bank

4. What source type is preferred for inclusion in a research-based literature review?

    A.   Textbooks
    B.   Meta-analyses conducted by scholars in the field
    C.   Peer-reviewed journals
    D.   Research manuals
    E.   Books published within the last 5 years

Language Sample Procedures

5. Ideally, a language sample should contain at least __ child utterances.

    A.   10
    B.   25
    C.   50
    D.   100
    E.   250

6. How should the adult communication partner encourage child language during the sample?

    A.   By asking questions
    B.   By responding to the child's communication bids
    C.   By modeling single-word productions
    D.   By imitating the child's productions
    E.   By initiating play

7. What elements of interaction are recorded on the language transcription form?

    A.   Child utterances and the words spoken by other people
    B.   Child utterances and the words spoken by the parent participant
    C.   Child utterances, words spoken by other people, and the communicative context
    D.   Child utterances, the communicative context, and child-to-adult proximity
    E.   Child utterances, child gestures, and words spoken by other people

8. When collecting a naturalistic language sample, it is most important to _____.

    A.   Record the child and communication partner(s) participating in typical family routines
    B.   Record the child primarily during play routines
    C.   Tell the parent to elicit the most language from the child as possible
    D.   Have a quiet environment
   E.   Inform the child to ignore the recording technology

Language Sample Analysis

9. To calculate MLU, the evaluator counts the number of morphemes produced in an utterance. How many morphemes are contained in the following sentence? *"I saw two birdees in the backyard."*

    A.   7
    B.   8
    C.   9
    D.   10
    E.   13

10. When calculating MLU, what types of utterances are discarded from the analysis?

    A.   Single words
    B.   Productions that contain articulation errors
    C.   Imitated words/phrases/sentences
    D.   Grammatically incorrect phrases/sentences
    E.   Words used with gestures

11. Which one of the following words is a diminutive form?

    A. Apples
    B. Riding
    C. Lifted
    D. Leapt
    E. Doggie

12. One method for determining discourse participation is to calculate the _____.

    A. Ratio of child to communication partner utterances
    B. Number of conversational responses a child makes in a 30-minute period of time
    C. Average number of words spoken during each conversational turn
    D. Mean length of utterance (MLU)
    E. Type-token ratio (TTR)

Answer Key: 1-B, 2-B, 3-B, 4-C, 5-D, 6-B, 7-C, 8-A, 9-B, 10-C, 11-E, 12-A

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Of 4 possible points in each task area, the average pretest score ranged from 1.4 to 2.0 and increased to 3.6 to 3.9 at post-test across the three areas. Scores increased the most within the language sample analysis area. Results of pre- and post-testing are provided in Figure 2.

Figure 2. Student Knowledge Related to Three Research Tasks. n=68
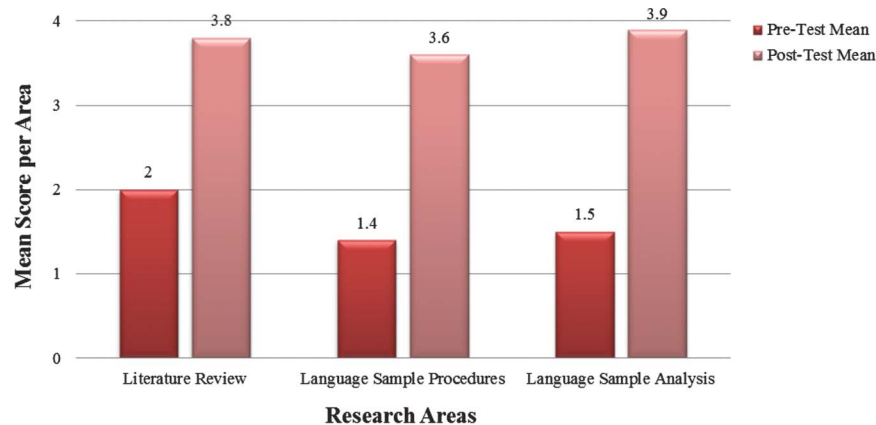
Student Dispositions

Because it was important to find out how students felt about their undergraduate research experiences, a survey was administered to student researchers during the semester following project involvement. The survey (see Figure 3) was completed after the semester and the submission of course grades to avoid potential positive bias in student opinions. This practice resulted in some attrition as 13 of the 68 student researchers could not be reached by the project director.

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Figure 3. Student Researcher Survey Eliciting Opinions on Undergraduate Research

Survey of Student Researchers

Project: *Preparing Scholars of Tomorrow to Effectively Analyze Language Sample Data for Parent-Child Turn Taking*

The first five questions are based on a 7-point rating scale. Please circle your response.

	7	6	5	4	3	2	1
a) Given the push for evidence-based practices in the field of speech-language pathology, how important is it for CSD students to be involved in research?	Extremely Important	Important	Somewhat Important	Neutral	Somewhat Unimportant	Unimportant	Extremely Unimportant
b) Thinking about the practical experiences that you have had as an undergraduate student, how valuable was your participation in the LENA research project?	Extremely valuable	Valuable	Somewhat Valuable	Neutral	Not that Valuable	Not Valuable	Really Not Valuable
c) Realizing that you will continue to learn and practice language sampling techniques in future courses and practicum experiences, how prepared do you feel to collect, orthographically transcribe, and analyze language sample data?	Extremely Prepared	Prepared	Somewhat Prepared	Neutral	Somewhat Unprepared	Unprepared	Extremely Unprepared
d) Rate your level of interest in conducting a graduate thesis using data collected during this project.	Extremely Interested	Interested	Somewhat Interested	Neutral	Somewhat Uninterested	Uninterested	Extremely Uninterested
e) How important is it for the university to continue to fund undergraduate research?	Extremely Important	Important	Somewhat Important	Neutral	Somewhat Unimportant	Unimportant	Extremely Unimportant

The next two questions are open-ended:

1. What did you learn from participating in the LENA project?

2. What are the benefits of undergraduate student involvement in research?

Further comments or feedback:

Thank you for participating in the project and completing this survey!

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Results for the first five questions on the student researcher survey are offered in Figure 4. It is clear that students recognized the importance and value of research participation both for the profession and the individual. Question (d) resulted in the lowest average response. However, given that the question asked students to rate their interest in completing a graduate thesis, it is remarkable that the average response leaned toward the side of interest (M=4.3). Graduate thesis work at the project university is an option that students have historically avoided. By showing students at the undergraduate level that research can be interesting, nonthreatening, and rewarding, it is hoped that more students will choose to complete thesis projects during their graduate programs. The vast majority (98%) of student comments at the end of the survey were very positive. Some of the more compelling student comments follow.

- Student involvement in this project gave us responsibility and a sense of belonging & importance. It gave us hands-on understanding of material we were learning in class.

- I believe it (research involvement) helps prepare you for grad school and gives you a better understanding of your major.

- It gives us the opportunity to have experience with clients and families. It also shows us the importance of client confidentiality.

- Undergraduate student involvement in research allows for insight into evidence-based practices.

- I wish we had more research projects that involve undergrad student participation.

- It was great to be a part of this research and I would do it again for no class credit.

Figure 4. Student Opinions of Research Participation Based on a 7-Point Likert Scale. n=55
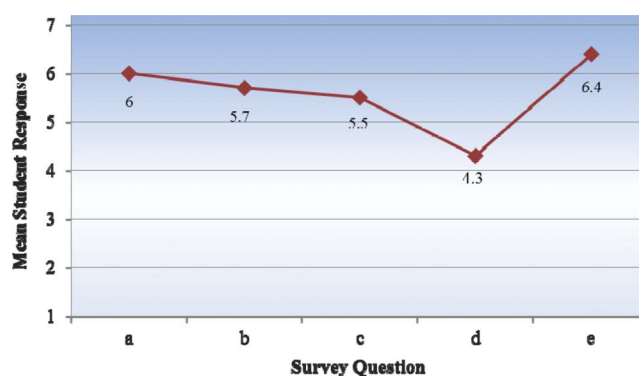
Discussion

In addition to advancing the research in child language development, this project enhanced the learning outcomes of undergraduate students and equipped them for future academic and clinical work. Students gained critical skills in child assessment procedures and learned how to engage in scientific inquiry. Knowledge and skills acquired through this project carry over into multiple courses, including diagnostics, child language disorders, clinical methods, cultural issues, consultative service delivery, and research methods. Further, student engagement in research prepares them to integrate evidence-based practices into their graduate-level practicum and future professional experiences.

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Increased content knowledge and the ability to apply such knowledge to child language research was evident as students completed ethical conduct in research training, contributed to an annotated bibliography, collected language sample data, and applied critical thinking skills in order to analyze research data. Perhaps more importantly, a change in disposition toward research was apparent as students gained an appreciation for the clinical aspects of research and learned that research can be exciting and rewarding. Student researchers involved in this project were challenged by the expectations set for them, but did not complain of extra work because they could see the connection between research activities and their future work as graduate clinicians and professionals. In fact, results of the disposition survey showed that students viewed research participation at the undergraduate level as highly important and valuable. Unfortunately, many students enter CSD programs with a dreadful outlook on research participation. By engaging students early in their undergraduate programs, academicians have the ability to alter such perceptions and demonstrate the approachability of scientific inquiry. Introducing students to research during their first semester of CSD coursework sets in place a habit of engagement outside the classroom and an expectation for research participation. It also has the potential to boost student confidence in a multiple areas, including client/family relationship building, clinical assessment, critical thinking, and the application of evidence-based practices. Further, research participation enables students to recognize their personal contributions to the development and study of evidence-based practices.

Through the application of qualitative and quantitative data analysis techniques, the undergraduate students from this project contributed to the scientific evidence base across multiple fields, including speech-language pathology, child development and education, psychology, early intervention, and family and child sciences. In addition to the 68 undergraduate students participating in the project, the two research assistants were intensely mentored for future research activity through their extensive involvement in project management; data entry, coding, and analysis; and dissemination of research findings. In accord with Hagstrom et al. (2009), it is the belief of project faculty that participation in scientific inquiry helped mold all of these students into research minded individuals who acknowledge the centrality of research in the daily practices of speech language pathologists.

Future Considerations

It is hoped that engagement in research becomes ubiquitous in undergraduate CSD education. Projects like the one described here are a start in the right direction. Faculty who desire to replicate methods shared in this article should consider the following modifications: (a) include a premeasure or survey of student dispositions prior to research experience and (b) collect data on the long-term effects of undergraduate research engagement. Long-term effects may include improved clinical performance at the graduate level, volunteering to assist in graduate research, or entering doctoral programs. After all, research is more likely to become a professional habit if it is introduced early in a student's CSD education (Hagstrom et al., 2009).

Acknowledgments

References

Collaborative Institutional Training Initiative. (2011). *The protection of human research subjects* [Online Module]. Miami, FL: CITI Program.

Coston, J., Jackson, C. W., Kashinath, S., & Callendar, M. (2013, April). *CSD students use LENA to analyze language sample data across diverse populations.* Presented at the LENA International Conference, Denver, Colorado.

Coston, J., Stonestreet, R., Myers-Jennings, C., Cox, J. R., & Lively, S. (2012, November). *Preparing CSD students to analyze language sample data using LENA*. Poster session presented at the American Speech-Language-Hearing Association Convention, Atlanta, Georgia.

Council on Undergraduate Research. (2014). *About the Council on Undergraduate Research* (CUR). Retrieved from http://www.cur.org/about_cur/

Friberg, J. C., Folkins, J. W., Harten, A. C., & Pershey, M. (2013). SIGnatures: Undergrad today, CSD PhD tomorrow: Special Interest Group 10, Issues in Higher Education. *The ASHA Leader*, *18*(7), 54–55. doi:10.1044/leader.SIGN.18072013.54

Friberg, J. C., Folkins, J. W., & Visconti, C. F. (2013). Using clinical and research activities to enhance the undergraduate experience. *Perspectives on Issues in Higher Education*, *16*, 81–85. doi:10.1044/ihe16.2.81

Gilkerson, J., & Richards, J. A. (2008, September). *The LENA natural language study*. Retrieved from http://www.lenafoundation.org/TechReport.aspx/Natural_Language_Study/LTR-02-2

Hagstrom, F., Baker, K. F., & Agan, J. P. (2009). Undergraduate research: A cognitive apprenticeship model. *Perspectives on Issues in Higher Education*, *12*, 45–52.

Individuals with Disabilities Education Improvement Act of 2004, Pub. L. No. 108-446 (2004). Retrieved from http://www.copyright.gov/legislation/pl108-446.pdf

Knowles, M. S., Holton, E. F., & Swanson, R. A. (2005). *The adult learner* (6th ed.). Burlington, MA: Elsevier Butterworth-Heinemann.

LENA Research Foundation. (2008). LENA Pro [computer software]. Boulder, CO: LENA Foundation.

McCollum, J. A., & Hemmeter, M. L. (1997). Parent-child interaction intervention when children have disabilities. In M. J. Guralnick (Ed.), *The effectiveness of early intervention* (pp. 549–576). Baltimore, MD: Paul H. Brookes.

Mueller, P. B., & Lisko, D. (2003). Undergraduate research in CSD programs: A solution to the PhD shortage? *Contemporary Issues in Communication Science and Disorders*, *30*, 123–126.

Paul, R., & Norbury, C. (2012). *Language disorders from infancy through adolescence: Listening, speaking, reading, writing, and communicating* (4th ed.). St. Louis: Mosby.

Retherford, K. S. (2000). *Guide to analysis of language transcripts* (3rd ed.). Austin, TX: Pro-Ed.

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., . . . Yoder, P. (2009). Defining spoken language benchmarks and selecting measures of expressive language development for young children with autism spectrum disorders. *Journal of Speech Language Hearing Research*, *52*, 643–652.

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