

## Collaborative Learning Strategies to Design Academic Science Curriculum for Elementary ELLs

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*Collaborative learning effectively generates Science curriculum for ELLs (English Language Learners) delayed or interrupted in L1 (first language) or L2 (second language) literacy fundamentals. Administration requires collaborative learning but lacks adequate curriculum to advance ELLs. This case study uses ELA (English Language Arts) and Science curriculum to develop collaborative ELL lessons, to maximize learning time and to instill best teaching practices. The study focused on one question: how can collaborative groups challenge science curriculum in reading and writing workshops for kindergarten ELLs? This question analyzes observations and reflections; while, investigating the adapted and differentiated curriculum for ELLs.*

**Keywords:** ELL, collaborative learning, ELA, science, elementary, kindergarten

### Context

The current research was adapted from “Plants as producers: A case study of elementary science teaching,” a case study by Smith and Anderson, from the Institute for Research on Teaching, College of Education at Michigan State University (1984). Their case study focused on the teacher’s use of curriculum materials in planning and implementing fifth-grade science content. The work was to focus on one of nine teachers being observed using an activity-based unit on plant growth and photosynthesis. There were four aspects to the inquiry of the teaching-learning observations: the curriculum materials, the teacher’s planning, actual classroom interaction, and students’ conceptions of the topics covered (Smith & Anderson, 1984). Even though this case study was written thirty-four years ago, it was chosen because the current researcher felt that its pattern of inquiry would gain insight to the research question at hand: how can collaborative groups challenge science curriculum in reading and writing workshops for kindergarten ELLs?

A crucial addition to the Smith and Anderson case study was to demonstrate how the current work focused on the use of collaborative learning. This particular facet in teaching and learning was not a focus from the original work, but its addition will make a valid case for why and how ELLs can advance their reading and writing skills in science classes, while strengthening their literacy fundamentals in their L1 and L2.

In an attempt to maintain the validity and reliability of the evaluated research, it was important to follow the case study procedures in order to explain the links from the real-life interventions that were observed in a kindergarten ELL setting and to describe multiple strategies administered that would illustrate certain topics in a real-

life context that occurred within the case study evaluation. The alterations to the Smith and Anderson case study are as follows: the current work focused on only one teacher's curriculum materials in planning and implementing kindergarten science, the teacher acted as the researcher and conducted their own observations using activity-based units on plants and their life cycle, weather patterns and season cycles. The four aspects to the inquiry of the teaching-learning observations were not disrupted: the curriculum materials, the teachers' planning, actual classroom interaction, and students' conceptions of the topics covered were integral parts of the case study that could not be overlooked or parts diverted from in the study. Finally, as point of reference throughout this paper, it should be noted that the teachers from the case studies will be referred to as "T1" from the initial case study and "T2" from the replicate study.

### **The Classroom**

T2 taught in a Title I public school. The students from the study were observed in a push-in and pull-out learning environment where all but one of the students were from various parts of Latin American or born in the United States from Latin American descendants; one child was from Southern Asia. The observed students had started the school year with little to no English language acquisition skills and the researcher acted as the ELL specialist as well as interpreter for the Spanish-speaking kindergarteners. Due to sufficient English language skills, the student from Southern Asia did not need any interpreters during classroom instruction.

The classroom demographics for this case study identified at least 90% of the children to be classified as students with interrupted formal education (SIFEs). Researchers from John Hopkins University suggest that SIFEs have experienced one of the following patterns: (1) they are newcomers with two or more years of education interrupted in their native country, (2) they have attended U.S. schools since pre-kindergarten but have language and literacy gaps due to ineffective instruction, or (3) they have attended school in one location for a few months, then move to another location for a few months, and perhaps there were some weeks between these changes when their attendance to school was absent (Colorín colorado, 2016). From these SIFEs patterns, the T2 observed that many of the ELLs lacked proficient literacy in their L1 and demonstrated academic gaps because they were not able to read or write in their native language, and they lacked an understanding of the basic fundamental literacy concepts, conceptual knowledge and critical thinking skills that some of their peers had been exposed to.

Overall, in an effort to use collaborative learning to search for answers to the research question, it is important to note that SIFEs have more to learn than English in their classroom settings. Therefore, it was T2's belief to use "two or more", a small group (3-5) students to teach and to plan science lessons that would create collaborative activities within an educational context. Hopefully, students are increasing their L2 fundamental literacy by using joint problem solving that will show

how learning can occur as a side-effect of the problem solving that is measured by the elicitation of new knowledge or by the improvement of the students' problem-solving performance (Dillenboug, 1999).

### **The Science Program**

The kindergarten science curriculum at T2's school was nonexistent. The current state science standards or the Next Generation Science Standards (NGSS) were not being administered nor were they of concern/interest to the administration. This lack of curriculum indicates that ELLs receive an inadequate or lack of proper science education, especially in the elementary grades. The recent demographic trends show astonishing rises in the proportion of ELLs and the enrollment of ELLs at the national level "has increased nearly seven times the rate of total student enrollment"; therefore, there is a great need for ELL instructors to design instruction that integrates content and language in the context of language immersion education and content-based instructions (Boove, Lee and Llosa, 2015). This statement alone demonstrates why this current research to develop collaborative learning activities using a content-based science program is crucial to advancing kindergarten fundamentals in reading and writing when it's completely absent from a school district's curriculum.

The observed kindergarten curriculum consisted of a state-issued ELA guidebook that focused on reading fluency and comprehension, but it lacked appropriate adaptations and differentiation of the materials to be used. The T2 noticed that the sections that would be taught throughout the year did focus on science concepts, such as the changing seasons, the plant cycle and various weather patterns. This led T2 to initiate an investigation to see what current research trends on elementary science curriculum could aid in collaborative learning styles that would advance academic language learning, and how the school guidebook would be implemented and adjusted to meet the science state standards and the NGSS; while, accommodating the ELLs diverse needs of meaningful learning.

From this investigation on elementary science curriculum, it was decided to use an online learning program called *Learning A-Z* and focus on two of its learning components *Science A-Z* and *Reading A-Z*. The use of this research-based curriculum was a suitable guide of content-based science instruction because it met the state-standards and NGSS while aiding in SIFE's receiving the fundamental literacy aspects that were desperately needed. The *Learning A-Z* curriculum allowed for the T2 to implement collaborative learning techniques, such as Collaborative Strategic Reading (CSR), Think-Pair-Share, Flashcard Game, Numbered Heads Together, and Pairs Compare (Kagan & Kagan, 2009; Klingner & Vaughn, 1998). From the use of this highly engaging curriculum paired with collaborative learning strategies, the T2 can identify with greater success how to create reading and writing workshops for kindergarten ELL science lessons that will help to retain language acquisition fundamentals when using adapted grade-level science curriculum.

### Methods

In accordance with the Smith and Anderson case study, the current research followed the researchers' methods, and adaptations were made due to the grade-level curriculum of the students being observed. The following paragraphs will show a comparison of how the original study helped to influence the methods to be used for the ongoing work, and it will also demonstrate how it allowed for various routines to be adjusted to meet the students' learning demands. There will be three aspects discussed for the teaching-learning situation: the curriculum materials, teacher planning, and actual classroom instruction (Smith and Anderson, 1984).

To begin with, the teaching materials that were used for the Smith and Anderson case study were from the publisher Rand McNally's science series entitled *Communities*. T1 conducted 15 lessons from the target unit over a 5-week period, and eight lessons were observed by researchers. The research was obtained by using classroom observations, audio recordings and informal interviews with the teacher. In comparison, the T2 study analyzed three units from the state-administered guidebook that was adapted using reading and science research-based curriculum from an online publishing source entitled *Learning A-Z*; which then focused on the programs two learning components: *Reading A-Z* and *Science A-Z*. The adapted ELA and science lessons took place over a six-month period with the T2 being the sole researcher during the study, which consisted of adapted lesson plans, on-site observations that included daily running notes, and self-reflections made by the T2 on student and lesson outcomes.

Smith and Anderson (1984) observed T1's initial planning and one daily planning session for Chapter 5 through onsite analysis and video recording. These running notes and video recordings were later reviewed with the researchers and the T1's to recall their planning process; which was then used to aid in the T1's future planning to obtain a better understanding of how the background information of the science unit would further enhance their planning process, goals and judgements about student learning and the unit features.

The current study contrasted the Smith and Anderson research. The second study did not have researchers observing the T2, but the current kindergarten ELA guidebook lessons were scrutinized meticulously by the teacher to inquire into its adaptability for their ELLs. T2 did not have the ability to audio or video record their planning sessions, but they would discuss current research and lesson ideas with the ELL department head for constructive feedback on lesson planning, ideas and goals for learning.

The next portion of the Smith and Anderson case study to be compared is how the actual classroom instruction was implemented. As it has been stated, the initial study consisted of fifth grade students, and the modeling study analyzed the work of kindergarteners. Even though the developmental learning stages are quite vast, the methods between the two teachers are similar in varying aspects: activities developed to promote specific learning outcomes, question and answer sections that were

reported by the teacher-directed and student-directed discussions, pre- and post- tests administered, and implementing critical thinking skills to help students in the discovery or inquiry-oriented philosophies of an academic science program (Smith & Anderson, 1984).

The following table displays a comparison of the T1 and the T2 summary on the events that occurred from the use of methods described earlier. The table reveals similarities and differences that occurred by using collaborative learning strategies among elementary students, and in a effort to support the necessary fundamental literacy skills required when working with a student population of ELLs and SIFEs.

Table 1 *Summary of Lessons*

Collaborative Learning Strategy	T1	T2
Think-Pair-Share	Essential question presented by T1 to students, but it was not discussed.	Essential question presented by T2 to students, and a KWL chart was used to elicit a student-directed discussion in L1 or L2.
Numbered Heads Together	Class presented with a new science concept and discussed possible outcomes as whole.	Class presented with a new science concept and discussed possible outcomes in pairs and reported answers through rich student-led discussions in L1 or L2.

(Smith and Anderson, 1984, p. 696)

### Conclusion

Although T1 and T2’s studies met differing obstacles with coursework and student outcomes, the teachers were able to observe and reflect upon that more collaborative opportunities for learning were essential, especially, the incorporation of media and manipulatives that encouraged further engagement of inquiry into the scientific processes of learning. At times, the instructors struggled with their students grasping the “big idea” of the science lesson, and although there was an increased awareness of the problem it did not always lead to an improved understanding that could offer a suggested solution (Smith and Anderson, 1984, p. 695).

### Implications

The results from these two case studies developed an awareness to a variety of significant positive and negative outcomes that arise in teaching elementary science. These outcomes indicate that highly trained teachers are able to implement lessons with a keen awareness to pedagogy that incorporates a well-managed classroom and provides accurate insight on the content objectives for students to achieve their expected learning goals, but when teachers are met with limited success from pre-and post-test data a major concern arises in the quality of professional development that was offered in training and the support that is provided to the elementary school teachers (Smith and Anderson, 1984, p. 695).

Smith and Anderson stated from their own implications that teachers need to be provided with implicit instructional strategies which can be supported by offering continuing education that requires two levels of knowledge to be attained: (1) the detailed knowledge of the specific unit and (2) knowledge of the conceptions of teaching and learning strategies employed in the units (Smith and Anderson, 1984, p. 695). Therefore, current school-district-stakeholders and administrators will continue to observe frustration with elementary science teachers if they do not have or develop the conceptions needed for teaching and learning that reflect the implications of the desired science objectives to be met academically by the students on a continuous basis.

A second implication that arose from the T2 case study was an awareness of the lack of home language support or exposure to the fundamental language learning skills required in a L1 or L2 academic environment. Throughout the course of the ELA lessons combined with science content it was ascertained that elementary ELLs who are delayed or interrupted in their L1 fundamental language skills will produce a slower rate of language advancement, due to the need to build background and increase their fundamental academic lexicons. This discovery led the researcher to demand for necessary parental involvement initiatives to be taken by the schools and their districts, so language learning grows from the ground up. These familial initiatives are an effort to instill fundamental literacy aspects that will improve school and parental relationships to foster a stronger learning community that will offer a richer education in a L1 or L2 home and allow the community to prosper as citizens involved in making their community enriched with a deeper understanding of how language learning pairs with community involvement.

In conclusion, the initial research question: how collaborative groups can challenge science curriculum in reading and writing workshops for kindergarten ELLs, found success through analyzing the work of T1 and T2 that was presented from the two case studies. The most important answer gained from the research question is that collaborative learning is imperative for all science teachers to incorporate in their teaching and lesson planning. As a teacher strategically implements, a Think-Pair-Share with a graphic organizer, the students are immediately engaged in a reading and writing workshop that is based on science content that the teacher is introducing at that time. This type of small group learning allows for a diversity of students to work together in a team setting that will equate to peers learning to depend on each other in positive ways for a variety of learning activities (Colorín colorado, 2015).

### References

- Author. (2015, December 01). Cooperative Learning Strategies. Retrieved from <http://www.colorincolorado.org/artide/cooperative-learning-strategies>.
- Author. (2015, December 01). Empowering ELL Parents & Families at Home. Retrieved from <http://www.colorincolorado.org/artide/empowering-ell-parents-families-home>.

## Collaborative Learning Strategies

- Author. (2016, January 14). How to Support ELL Students with Interrupted Formal Education (SIFEs). Retrieved from <http://www.colorincolorado.org/artide/how-support-ell-students-interrupted-formal-education-sifes?theme=print>.
- Classroom Strategies. (2018, May 25). Retrieved from <http://www.readingrockets.org/strategies/think-pair-shair>.
- Dillenburg, P. (1999). *What do you mean by collaborative learning?* Oxford: Elsevier, pp.1-19.
- Getting Parents Involved in Schools. (2013, November 07). Retrieved from <http://www.readingrockets.org/artide/getting-parents-involved-schools>.
- Kagan, M. (2009). *Kagan Cooperative Learning*. Kagan Publishing.
- Lee, O., Llosa, L., Jiang, F., Haas, A., O'connor, C., & Booven, C. D. (2016, 02). Elementary teachers' science knowledge and instructional practices: Impact of an intervention focused on English language learners. *Journal of Research in Science Teaching*, 53(4), 579-597. doi:10.1002/tea.21314.
- Llosa, L., Booven, C.D., & Lee, O. (2015, 07). Teaching content standards to English language learners: Elementary science teachers' use of language development and home language strategies. *NYS TESOL Journal*, 2(2), 6-19.
- Patchen, T., & Cox-Petersen, A. (2008, 11). Constructing cultural relevance in science: A case study of two elementary teachers. *Science Education*, 92(6), 994-1014. doi:10.1002/sc.20282.
- Smith, E. L., & Anderson, C. W. (1984, 10). Plants as producers: A case study of elementary science teaching. *Journal of Research in Science Teaching*, 21(7), 685-698. doi:10.1002/tea.3660210703.
- Using Collaborative Strategic Reading. (2013, November 07). Retrieved from <http://www.readingrockets.org/artide/using-collaborative-strategic-reading>.
- Watters, J. J., & Ginns, I. S. (2000, 11). Developing motivation to teach elementary Science: Effect of collaborative and authentic learning practices in preservice education. *Journal of Science Teacher Education*, 11(4), 301-321. doi:10.1023/a:1009429131064.
- Yin, R. K. (2008). *Case study research: Design and methods*. Sage.
- Zee, E. H., Hammer, D., Bell, M., Roy, P., & Peter, J. (2005). Learning and teaching science as inquiry: A case study of elementary school teachers' investigations of light. *Science Education*, 89(6), 1007-1042. doi:10.1002/sc.20084.