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About the Journal

Founded in 2013, the Journal of Teacher Action Research (ISSN: 2332-2233) is a peer-reviewed online journal indexed with EBSCO that seeks practical research that can be implemented in Pre-Kindergarten through Post-Secondary classrooms. The primary function of this journal is to provide classroom teachers and researchers a means for sharing classroom practices.

The journal accepts articles for peer-review that describe classroom practice which positively impacts student learning. We define teacher action research as teachers (at all levels) studying their practice and/or their students' learning in a methodical way in order to inform classroom practice. Articles submitted to the journal should demonstrate an action research focus with intent to improve the author's practice.

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USING ACTION RESEARCH TO DEVELOP DATA LITERACY IN INITIAL TEACHER EDUCATION

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Abstract There is a call for higher education institutions and professional learning providers to support pre-service teachers (PST) in developing competency in data literacy through clinical (classroom) practice. However, PST rarely have the opportunity to collect and analyze data that is relevant to their own classroom practice. In this paper, we put forward the results of a study that centered on PST conducting their own action research project during a ten-week professional experience placement in a high school. The aim of the PST's action research studies was to demonstrate that their data-driven pedagogical decisions had a positive impact upon their students' learning outcomes. It was found that while all of the PST could develop a research question and collect data, they needed more explicit training in action research and data literacy skills to develop a range of competencies that would support them in making nuanced data-driven learning and teaching decisions in the classroom.

Keywords: teacher action research, initial teacher education, data literacy, professional learning, Proof of Ongoing Learning (POOL)

Introduction

There is a call in research for higher education institutions and professional learning providers to encourage competency in data literacy through clinical (classroom) practice

(Bocala & Parker Boudett, 2015). The consensus is that providers should offer courses that combine training in real school settings using authentic examples, such as data from their own school or local area (Mandinach, Friedman, & Gummer, 2015). These studies put forward a similar line of argument, in that in-service teachers need ongoing access to professional learning using authentic data in real world contexts. While there is a growing body of literature on in-service teachers and data training, there is a lack of research on how best to train pre-service teachers (PST) in developing their data literacy (Reeves & Honig, 2015). There is limited research on how to skill PST in using data in terms of what data they will access, how to collect and analyze data, or even how to present the story of the data in a format that is appropriate for stakeholders to understand. These are the skills necessary for being data literate. Gaining these capabilities is confounded by the complexities of providing PST with access to authentic learning contexts during their initial teacher education.

The aims of the study were to show how PST, while on a 10-week professional experience in a high school, demonstrated Proof of Ongoing Learning (POOL) and how their pedagogical decisions had a positive impact on their students' learning. The PST undertook an action research project that centered on their own classroom context. Here, we examine the PST's understandings of how and why they undertook the action research project, and how they collected and represented their data to determine POOL. The notion of POOL is put forward by the authors as a means of understanding how being data literate has a significant impact the role of teachers. Being able to *prove* that a student is learning is at the center of teachers' work where learning occurs over the period of a set timeframe, such as across an academic school year. It is important for PST to have the skills and strategies to be able to collect and measure data to show that their students are learning, where and when they are learning, and how the learning can be further enabled. We argue that action research provides the framework through which PST can make informed learning and teaching decisions. The research questions that framed the study are:

- (1) What is the role of action research in initial teacher education?
- (2) What drives PST in their decisions to collect and use data?
- (3) How can professional learning sessions in data literacy be better designed to facilitate deeper learning for the PST?

Literature Review

Data literacies in initial teacher education. In initial teacher education, data literacy in the classroom is gathering attention as a necessary graduate skill. Data literacy has been put forward as being a panacea for school and system improvement. Data literacy includes data-rich activities ranging from local school-based assessments and examination results to state, national, and international benchmarking (standardized) assessments. It has been argued that educators need to be taught how to use data to identify sub groups, challenge views on students and student progress, understand student thinking, and to confirm what they know about them (Quint, Sepanik, & Smith, 2008). The research clarifies that educators are increasingly responsible for making use of these multiple sources of data about student learning and school-based decisions as ways of seeking improvements in teacher

professional learning and school management (Bocala & Parker Boudett, 2015; Coburn & Turner, 2012; Wayman & Jimerson, 2013).

Vendlinski and Phelan (2011) posit that effective professional learning initiatives should focus on providing three aspects of development: developing the content knowledge of teachers in the domain of use; developing a community of teacher learners, in this sense a Community of Practice as articulated by Lave and Wenger (1998); and allowing teachers to explore students' work including both accurate and inaccurate examples. Studies have demonstrated that in-service teachers favourably viewed classroom-contextualized interventions using authentic data, preferably from their own school or district, and that they value opportunities for collaboration and the social framing of data use (Farley-Ripple & Buttram, 2015; Gerzon, 2015). Mandinach and Gummer (2015) found that while teachers have some understanding of how to use data, they lack the skills to be effective. Mandinach and Gummer (2015) further articulate that teachers working in teams can compensate for the individual lack of competencies thus further advocating the social framing of data literacy put forward by Farley-Ripple and Buttram (2015).

Educators and those training to be educators need mastery in their data skills in order to be able to work as individuals and to be part of collaborative conversations on using evidence to make instructional decisions (Bocala & Parker Boudett, 2015). In their research on PST data literacy, Reeves and Honig (2015) contend that, "data literacy can assist teachers in moving from an intuitive, disorganized, undocumented, "in the head" process of assessing their students to a systematic, consistent way of monitoring student progress" (p.90). Educators need to be able to collect appropriate data to inform learning and teaching decisions and to be able to present these decisions and their effects to their key stakeholders. This need for data creates a push back on higher education providers that offer initial teacher education programs to upskill PST in being data literate as there is an expectation that PST will graduate with the capacity to collect, analyze, and produce data and data driven outputs.

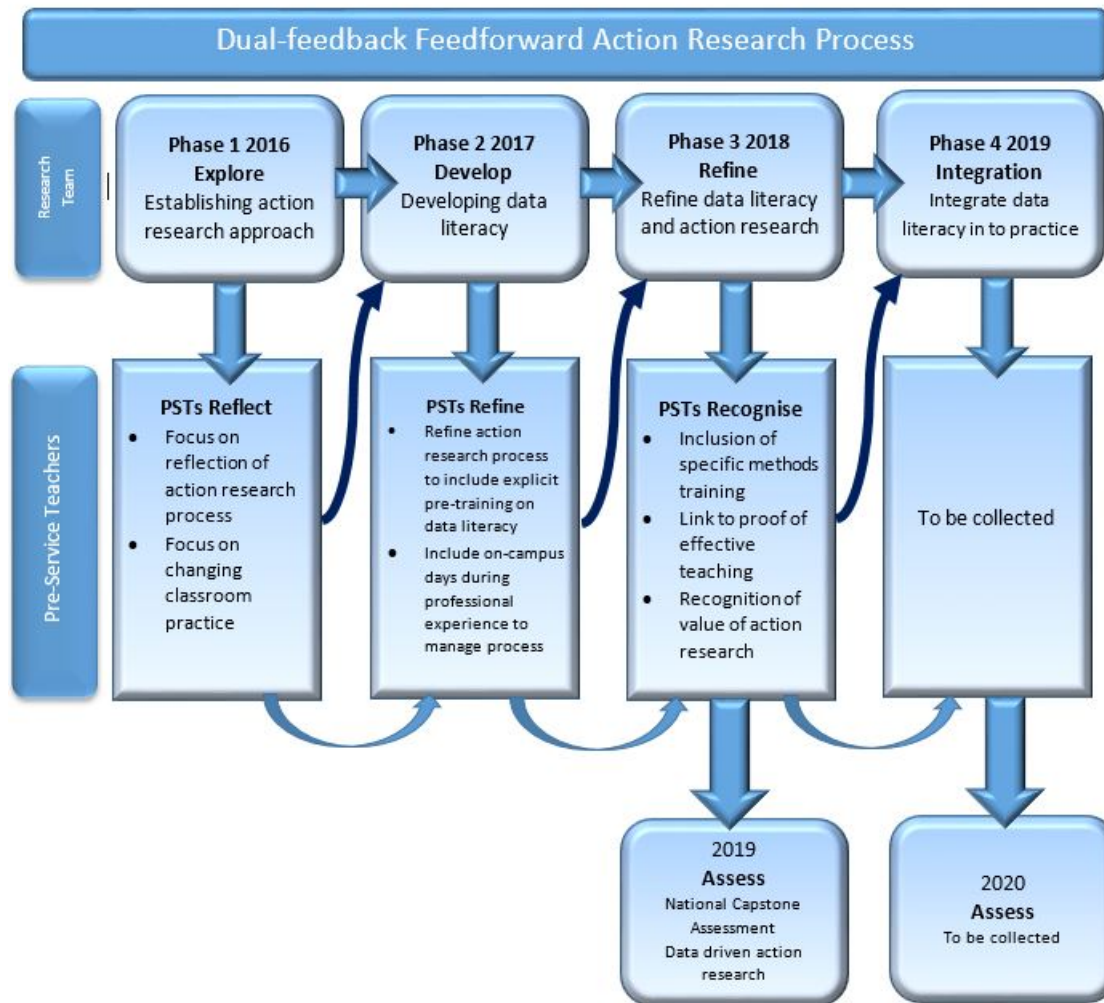


Figure 1: Dual feedback action research model

Action research in initial teacher education. Action research, in general, falls within a qualitative research paradigm and centers on research undertaken on action (Cohen, Manion, & Morrison, 2007). The methodology and methods used to conduct action research are diverse (Cohen et al., 2007; Kemmis & Mc Taggart, 2000). The expansive body of literature on action research, which spans more than seventy years, articulates four key features characteristic of action research study (Lewin, 1946; Mertler & Charles, 2008; Cordeiro, Baldini Soares, & Rittenmeyer, 2016). These four characteristics being: 1) participation and collaboration; 2) a constant and iterative cycle of self-reflection, which includes planning, acting, observing, and reflecting; 3) knowledge generation; and 4) practice transformation. The action research model applied in this study was based on the four phases and relied on dual modes of feedback to refine the overarching research design and the PST's action research model and data literacy training. The study also draws upon the action research model put forward by Kemmis and McTaggart (2000), which is centered on an ongoing cycle of planning, action, and reflection. Traditionally, an action research study may have a clear beginning; however, there is often no clearly defined endpoint. The

current study is in its fourth year, and with each round of data collection we have developed a deepened understanding of how action research can be used to inform course design. The study, which commenced in 2016, was designed to run over several phases. Each phase of the research constitutes one course offering (i.e. the course is offered annually). This paper is centered on Phase 2, and the data was collected from July to November 2017.

A central feature of action research is that revisions and improvements are made within a cycle so that changes are implemented as part of improving the outcomes/design in the following and subsequent cycles. This can be seen in the model (Figure 1) where there is a dual-feedback loop. The cyclical nature of action research provides opportunities for both educators and PST to learn from the previous research phases (Mertler & Charles, 2008). Feedback from students has been shown to be a valuable resource for improving the learning designs (Mandouit, 2018). In this sense, the design of this action research project is a significantly iterative process where the researchers refine the model and the materials; the PST learn from their own experiences and from viewing past assessments, the PST feed their new knowledge and experience into subsequent assessments and teaching, and the research team keep learning after each iteration. The PST used a linear action research process as this worked well with the design of their course and professional experience (Figure 2).

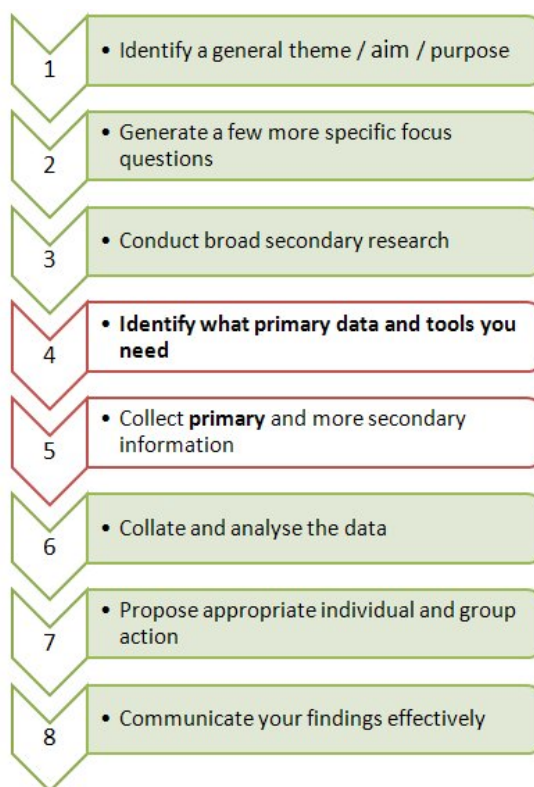


Figure 2: Action Research Model (preservice teachers)

Methodology

Research context. In order to develop their data literacy, PST in Year 3 of their secondary teacher education program were required to undertake an action research project while on

professional experience. PST were required to identify a research area and relevant research questions for the development of a research study that integrated the collection and analysis of data. This provided the PST an authentic learning and teaching experience. The PST participated in a one-week intensive course on high school teaching methods prior to their professional experience. The intensive course comprised 20 hours of face-to-face classes (i.e. five days of four-hour classes). The remainder of the course (i.e. six weeks of four-hour classes) was conducted post professional experience. The methods course is a mandatory course for initial teachers in the State of New South Wales (NSW Education Standards Authority, 2017). As part of the intensive week, PST attended lectures/seminars about action research; the importance of developing a research question; and the basic statistical functions necessary for teachers to use, such as data displays using box and whisker diagrams and scatter charts. Basic statistical metalanguage was explicitly covered in the workshops, and terminology, such as population group, pre-test, mean, median, participants, data, data analysis, and visualizations, was also addressed.

In the first fortnight of their professional experience, PST had to identify a learning and teaching issue and develop a strategy for implementation in one or more of their classes. They were then required to design an action research study. Scaffolding was provided to guide PST through the required cycles of learning so they were better able to implement their interventions. The completed action research projects were submitted at the conclusion of semester as a summative assessment. A scaffold was provided to support PST in writing up the results of the action research project. The scaffold was in the format of a journal article template. This was deemed an appropriate format as the PST were familiar with academic papers, and it provided the PST with an understanding of how research papers are generated.

Data Collection and Analysis

Participants. This study involved a cohort of third year PST at a metropolitan university in Sydney, Australia. The PST must study two Key Learning Areas (KLA); for example, maths and English, as part of a secondary teaching degree. Twenty-five PST submitted their action research projects for analysis. This is a 56.8 percent response rate, which is viewed as acceptable (Nulty, 2015). Thirty PST completed the survey out of an enrolment of 44 PST. This is a 68.2 percent response rate, and is viewed as an acceptable response rate in social sciences research (Nulty, 2015). No persuasive measures or incentives were offered to participants to participate in the study. It should be noted that the researchers are also participants in the study; however, our views are not presented here.

Action Research Projects (summative assessments). The action research projects were submitted as summative assessments. They were not analyzed until after the PST's final grades were confirmed. The data was coded thematically, and the themes were drawn from the action research project template that the PST were provided with to present their findings. This approach to coding is deemed appropriate by Mason (2012). We were aware that when we were coding the projects that the categories may not be consistent and that

there was likely to be some blurring between the codes. In particular, we expected to have some cross over in the categories for the area of research, data sources, and methods of visualization as these were unpacking the PST's own understanding of their research design.

Survey. The survey was administered at the University during an on-campus session one week after PST completed their professional experience. It was an expectation that the PST had already generated a draft of their action research findings so that they would be able to respond to the survey. The survey comprised 15 items. Twelve items were open-ended and three provided listed options. The survey was first administered in 2016 to a cohort of PST completing the same, albeit now revised, project (Kennedy-Clark et al., 2018). Analysis of the surveys involved discovering patterns, themes, and categories in the data. This was essential as these themes and categories could be used in the later phases of the study in subsequent years. Simple frequency analysis was used for analysis and the frequencies are represented as percentages.

Results

Two sources of data are presented in this paper: the action research projects (final PST assessment) and a post-intervention survey. The three main themes to be discussed in relation to the data are 1) action research and the role of action research in initial teacher education; 2) research topics and data collection techniques; and 3) PST's perceptions of action research project.

Action research projects. The action research projects are PST's final summative assessment that reported on the findings of their action research study. The action research projects were analyzed individually using these pre-determined themes: research area, literature sources (secondary evidence), data sources, data visualization, and level of competency. From the 25 action research projects that were analyzed, it was evident that 14 of the PST's projects were deemed to be at a novice level of competency, nine were deemed to be developing, and two were not included as alternative assessments were submitted. The measure of novice, developing or competent was based on the PST's selection of the visualization and its appropriateness for the data source, the level of complexity in describing the data, and the reliability of the outcomes presented. The PST's research projects covered a range of research areas (Figure 3) with the main research area exploring the different teaching methods (60%, $n=15$). The topic of different teaching methods explored different pedagogical strategies, such as problem-based learning, inquiry learning, setting learning goals, strategies for EAL/D students, and scaffolding learning. Three PST (12%) investigated the topic ICT in Education.

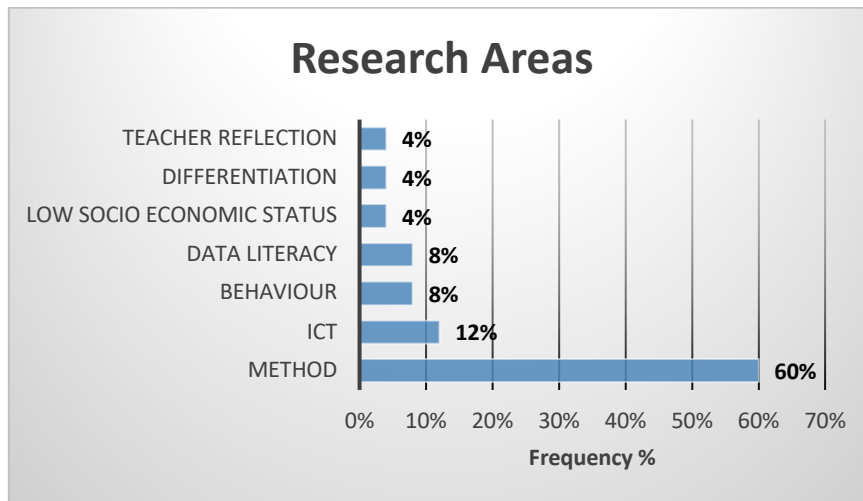


Figure 3: Research areas (topics)

Regarding data collection strategies PST used, twelve PST (48%) had a pre-test, post-test approach with a further ten PST (40%) having a pre-test, mid-test, post-test approach. Two PST (8%) had a combination of observations and documentary analysis. Two PST (8%) did not collect data due to in-school factors, such as changing supervising teachers or class mid-way through their professional experience. A range of data visualization types were used by the PST. Ten PST put forward two visualization types such as bar graphs and pie graphs. These representations are presented in Figure 4, whereby a total of 35 visual representations were analyzed. The most frequently used representations were bar graphs (20%, $n=7$), pie graphs (17.1%, $n=6$), numeric tables and dot plots, both with a frequency of 14.3% ($n=5$). What is evident from the analysis of the action research studies is that the PST were largely able to design an action research project and collect classroom data. However, it was found that the representations used by PST were largely naïve. PST were using pie charts and bar graphs to present test results instead of more appropriate visualizations, such as box and whisker diagrams. We surmise here that the research team needs to provide far more detailed and prolonged support in developing PST's data literacy and data reporting skills.

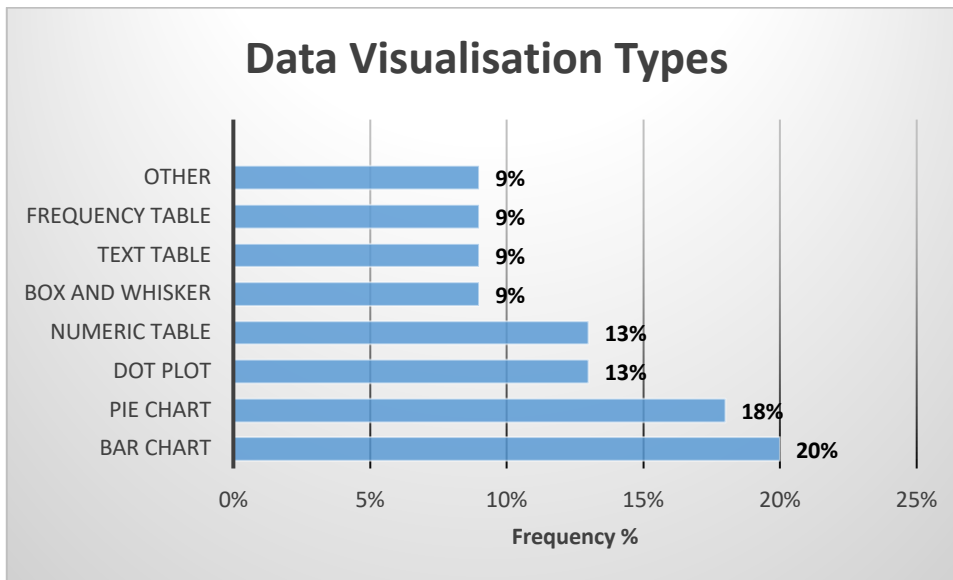


Figure 4: Data visualisation types

Post-intervention survey results. The survey results complement the findings of the action research projects. In some instances, there is an overlapping of the findings.

Action research and the role of action research. In order to provide context on the main research areas, survey item one was aimed to elicit a definition of action research from the perspective of the participants. Less than 30% ($n=9$) were able to accurately define action research in terms of improving or informing teaching practices. One PST specified that action research was:

studies carried out in the course of an activity or occupation typically in the field of education to improve the methods and approach of those involved [female, English teacher].

Thirty three percent of responses ($n=10$) defined action research as collecting data to answer a research question. For example, a PST stated that action research was:

undertaking research aimed at providing data and information showing how different students learn and develop [female, history teacher].

A further five PST (17%) described action research in terms of ongoing practice, undertaken whilst teaching. Three responses (10%) were ambiguous and this impacted upon understanding (e.g. incorrect word choice). For example, “the development of their writing and literacy skills” and “behavior management” were provided as answers. Three PST did not answer. What this suggests is that despite the training sessions on action research and the explicit training in metalanguage, the PST needed more exposure to the concepts underpinning action research. That is, their metalanguage of action research needs a more concentrated effort by the teaching team.

Item two asked respondents to: “Describe your action research project and why you selected this area for investigation. (i.e. what did you do, how did you plan it, and why did you investigate this area)”. Given that this item was asking participants to describe their

own studies, there was, to be expected, a diverse range of answers. Examples of response include:

I researched the effectiveness of positive behavior management on student learning. I compared student centered and teacher centered learning [female, history teacher].

My project assesses the effectiveness of the use of relevant examples in order to enhance learning capacity. This was constantly performed through daily substitution of examples of globalization in order to appeal to a year 8 female class [male, geography teacher].

My action research question is centered around students' interests and how they can have an impact on classroom engagement if incorporated in the content. I planned to collect data by observing my students' behavior and engagement when their interests were incorporated in the lesson [female, history teacher].

What was evident from the analysis of the participant responses it that they were all able to identify a target population and articulate a learning and teaching intervention.

Item three asked the PST to: "Describe your perceptions of the teacher's role as related to action research (i.e. how did you see your role as teacher and researcher)". Fifty-seven percent of respondents ($n=17$) indicated that their perception of the teacher's role was related to improving teaching, student learning, task design, understanding students, teacher as a "guide", assessing learning, and supporting learning. Seventeen percent ($n=5$) were pragmatic about the action research process and described it in terms of actions to be completed without any mention of teaching and learning. In this respect, they made reference to the practice of collecting data rather than the implications of the research on the learning and teaching. Ten percent ($n=3$) saw themselves as a teacher and not a researcher and made no mention of the learner or learning. A further ten percent ($n=3$) provided ambiguous responses in that they were not related to the question (e.g. good and professional). A final seven percent ($n=2$) provided no response. It was positive to see that over half of the respondents linked action research to their learning and teaching

Overall, in relation to the research question: What is action research and the role of action research in education? It is evident that while most PST had a working understanding of action research, they needed more exposure to action research in order to better conceptualise the process. Secondly, the PST needed opportunities to see the connections between collecting data and making classroom decisions.

Research topics and data collection. Several survey items were designed to elicit information pertaining to what the PST thought that their main research topic was, how they collected their data, and why they made those choices. As part of the study, we wanted to understand how the PST knew that their interventions were working. This was to ascertain if the PST could establish POOL. We asked, in item four to: "Describe how you measured if your action research had an impact upon the classroom (learning, behavior etc.) (i.e. how do you know if it worked)". In regards to how PST measured the impact of their interventions, 43 percent ($n=13$) indicated that they used summative measures, such as pre, mid and post-tests. A further 57 percent ($n=17$) indicated that they used a range of formative assessments. These included formal tasks, such as quizzes, work samples, and

experiments, as well as informal measures, such as observations of engagement and participation and feedback.

Item five was a multiple-choice question with a list of research areas, and the PST were able to select more than one option. The research topics covered differentiation, gifted education, assessments, and communication. Given that the action research topics centered on investigating a problem within their classrooms, these topics all fall within the scope of what a teacher would normally encounter in their classrooms, and the findings are consistent with the data gathered from the action research projects.

In item six, the PST were asked to provide their data collection processes. In Figure 5, it is evident that pre-tests and post-tests and student work samples formed the basis of the PST's data (33%, $n=20$). Observation of students in class comprised 26 percent ($n=16$) of the participant responses. What this indicates is that the PST were able to select techniques to measure student learning. What is of note is that item seven asked the respondents why they selected these techniques. It was found that 53 percent ($n=16$) selected data collection techniques that were appropriate, 33 percent ($n=10$) used the easiest measures, and 10 percent ($n=3$) used a range of techniques to get better variety in the data. One PST did not respond.

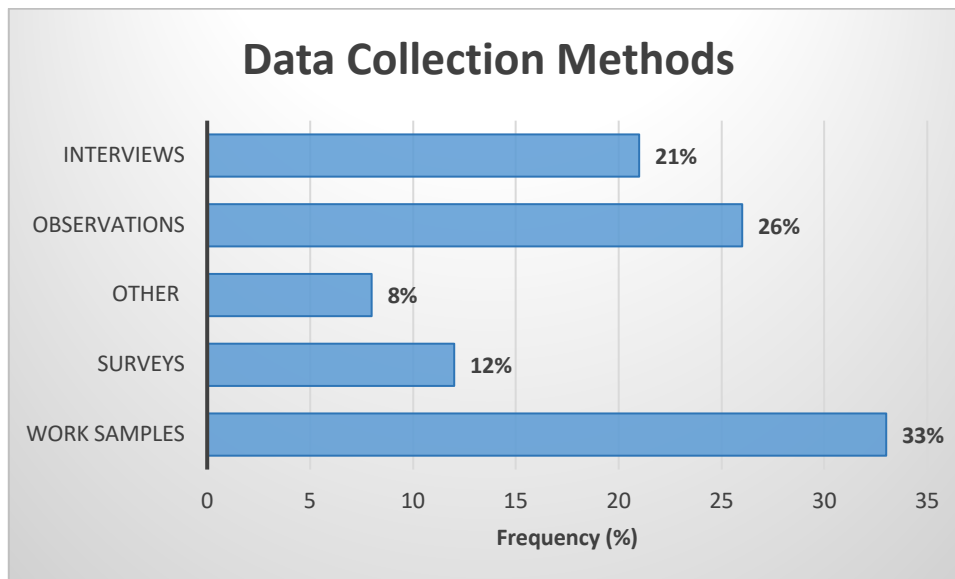


Figure 5: Data collection methods

The aim of items 8 and 9 was to further elicit how PST established POOL using data that they had collected. In item eight, participants were asked: "How did you analyze your data? (i.e. what did you do to make sense of your data?)". The response for this item demonstrate that 47 percent ($n=14$) of the PST used comparative analysis between test results or other student work samples. Twenty percent ($n=6$) of the PST provided descriptive responses about analyzing data into graphs and tables and that is it was related to the visualization of the data. Twenty percent ($n=6$) indicated that they used document analysis of student work.

Thirteen percent ($n=4$) of the PST either provided either no responses or unrelated responses.

The PST were asked in item nine “how they represented their research findings in their action research project (i.e. how did you show what you found)”. This was a multiple choice question. As PST were expected to collect multiple sources of data, we assumed that they would provide multiple responses to this item. In some instances, three to four responses were provided. Results are provided as percentages. Figure 6 expresses that 36 percent of the respondents used some form of text description and 29 percent used a table with numbers. Twenty-one percent of the respondents used a table with text and 11 percent used a graph, such as a box and whisker diagram or a dot plot. Three percent of the PST selected other forms of representation, and these forms included images and verbal analysis.

In item ten, the final question in this section, the PST were asked why they selected these methods of representation. The responses here fell into two broad categories. Sixteen PST (53%) indicated that it was the most appropriate or effective way to show their results. Twelve of the PST (40%) indicated that representing the data as they did was the easiest way to do so. One PST did not respond, and one PST provided an invalid response.

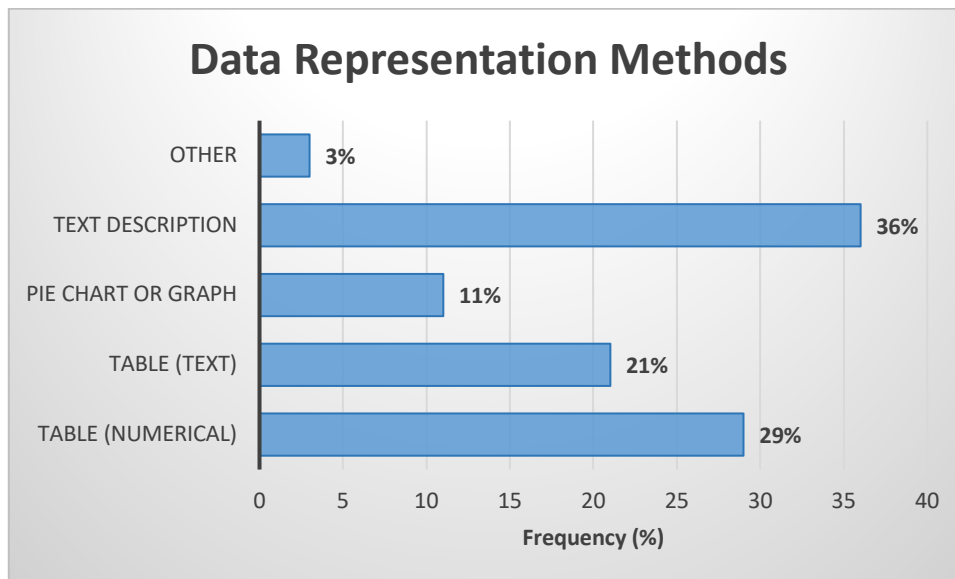


Figure 6: Types of data representation in the action research project

In relation to the research question, “How did students collect and use data (i.e. what drove their decisions)”, it was evident that all of the PST in the study were able to collect a range of data types and to undertake basic analysis. However, it was apparent from the survey results that the choices in some cases were driven by ease rather than effectiveness.

Perceptions of action research. In order to gain an understanding of the PST’s perceptions of action research, they were asked to respond to several items pertaining to the action research process, the challenges of action research, and the potential benefits. When asked about what they needed to know to support their research 47 percent ($n=14$) of the PST

indicated that they needed to know more about how to collect and analyze the data. One PST indicated:

How to improve the results of the next time you test a question [female, drama teacher]

How to gather data better [female, English teacher]

Two PST (7%) indicated that they wanted to know about when to collect the data and how to manage the time requirements. Two PST (7%) indicated that they wanted to know how to measure student ability and not attitudes. Nine PST (30%) provided no answer, a further two stated “nothing” and one PST indicated that it was a waste of time.

Item 12 asked the PST to: “Describe the challenges and benefits of doing action research as a teacher in a classroom”. Multiple responses were provided for this question, where the benefits included getting to know the students and their learning, improved teaching, and knowing if the students are progressing. Examples of responses include:

You see the progression of the students after implementing the action [male, religion teacher]

Helps keep tabs on whether the students are progressing and where they are [male, HSIE teacher]

You can self-evaluate your own teaching practices [male, English teacher]

Some of the challenges raised by PST included that it was time consuming, hard to collect specific data, and there was a split focus between teaching and research. PST responses included:

The challenge is having a concrete aim and distilling the data needed to fulfil the demands of that aim [female, English teacher]

Not everything works. Not everyone will relate [female, maths teacher].

It was evident from this question that PST perceived the benefits in being able to see student learning and the impact of their own teaching. The challenges center on the pragmatics of conducting a research study and the tension between teaching and research. This is linked to Item 13 which asked the PST to: “Describe the impact of the action research on your own teaching practices as related to their participation in the action research. (i.e. how did the action research affect your teaching – if it didn’t and why)”. In response to this question, 53 percent ($n=16$) of the PST indicated that the action research project had an impact upon their learning and teaching strategies and led to a better understanding of lesson planning, lesson content, the use of ICT, and differentiation or different teaching strategies. By way of example, one PST wrote that:

Positively. Helped me to understand my students’ specific learning preferences along with the types of tasks that they liked [female, drama teacher]

A further 17 percent ($n=5$) stated that it helped them to reflect critically on their teaching or to become more observant indicating that it had an impact upon how they viewed themselves in the classroom. For example, one PST claimed that:

I have the opportunity to ask if I've improved and how that came about [female, HSIE teacher]

An additional 17 percent ($n=5$) indicated that they were not sure if the action research had an impact, as one PST stated:

I don't think it did. I'm not sure if I would change my teaching style [female, history teacher]

Two PST stated that it made them focus on the final assessment (7%), three PST (10%) did not respond, and one PST (3%) indicated that they sometimes forgot to do the action research. It is apparent from the responses to these two questions that the action research provided space for the PST to critically reflect upon their own teaching approaches.

The final Items, 14 and 15, gave the PST an opportunity to anecdotally outline their views on action research. Item 14 asked: "As a pre-service teacher, what are your thoughts on action research assessments during practicum? (i.e. good, bad, how they can be improved)", and Item 15 asked "Any final thoughts?" In response to item 14, just under half of the PST (47%, $n=14$) indicated that they found the action research challenging or difficult and this was mainly due to the issue of managing both the time taken to plan and develop lessons and the balancing of this with the action research. As one stated:

Prac is stressful. Maybe when I am an actually teacher it will be better [female, English teacher]

Professional experience is high stakes for the PST, so these comments are understandable. Professional experience is 10 weeks of teaching in a new environment, with new students, and their every action is under scrutiny. There is a need to demonstrate that they have achieved specific teaching standards, so this coupled with an assessable action research project is, understandably, burdensome. Getting support from the supervising teacher also came up as a challenge, as one PST articulated:

Can be quite stressful. My supervising teacher was very resistant to a mid-test. He thought it was useless [male, HSIE teacher]

Thirty-seven percent ($n=11$) of the PST thought that it was beneficial, one supplied:

Good! Helps us focus on our teaching and how we are going. Are we being effective? [female, English teacher]

Four PST (13%) stated that the action research was both good and bad. As one provided:

They are good and bad at the same time as they place more pressure on us but allow us to test our teaching methods [male, religion teacher]

One PST did not provide an answer. In regards to the final item on the survey, only four PST provided responses, one stated "I liked the action research", one wrote "good", one wrote

“very complex” and the final one added “please no more”. What this indicates is that there was a mixed view about the action research. The main barrier lies in the time taken to plan and organize the action research with the PST feeling like it detracted from their actual teaching.

In regards to the third research question: “How can the data literacy sessions be better designed to facilitate deeper learning?” There are a number of recommended improvements including more explicit training in the metalanguage; more exposure to the data collection and analysis techniques; and explicit training in writing up the results. The perceived benefits of the action research are that it improved PST’s teaching and understanding of what works in a classroom. It also provided space for a critical lens from which to view their teaching and to establish POOL. That is, by doing the action research, PST had a structured process through which they could establish student progress. In this respect, the benefits do outweigh the challenges as the challenges seemed to be linked to the administration and organization of the action research rather than the action research itself. It could be argued that asking the PST to keep a learning journal or to read academic papers would also be seen as being burdensome. Thus, the overall approach to embedding action research into professional learning has had a positive impact upon the PST. The action research process may also raise their awareness about how to manage their workloads more efficiently and to better prepare themselves for the rigours of the workplace.

Discussion

The results of this study have further strengthened our belief that considerable attention needs to be paid to developing PST’s understanding of action research and data literacy. The results confirm existing research on data literacy in initial teacher education. For example, it was found that conducting the action research in their own classes meant that the data was contextualized and, therefore, more meaningful (Farley-Ripple & Buttram 2015; Gerzon, 2015). One issue raised by Goodyear, Markauskaite, and Kali (2009) is that it may be “all too rare for university teachers to have timely, valid and reliable data on student achievement. This is a major problem in the assessment process itself, but also handicaps any attempts at evidence-driven iterative design” (p.15). This is in alignment with the New London Group’s (1996) claim that Situated Practice is learning grounded in students' own life experiences and draws drawing upon a constructivist understanding of how people learn. Hence, through designing their own study in the context of their own classroom, the PST are situated in the context of the selection, collection, and analysis of their own learning and teaching data, which may create a more nuanced understanding of how data can be used to inform learning and teaching decisions.

Developing an understanding that data literacy for initial teachers includes the development of three skill sets may help address these issues. These three skill sets being: 1) *problem-focused skills*, such as knowing how to frame questions, identify problems, and to make informed decisions; 2) *data-focused skills*, which include knowing how to access, generate, and interpret data; and 3) *process-focused skills*, which include knowing how to engage in collaborative inquiry and to evaluate cause and effect (Mandinach & Gummer, 2013). Hence, for the PST to be considered to be data literate, they should be able to understand, analyze, and to act upon multiple forms of data about student learning (Coburn & Turner,

2012). It was evident from the results that the PST could make learning and teaching decisions on the basis of the data they collected.

Three findings that are linked to the research design are that: 1) it was evident that the PST needed more explicit training in the metalanguage of action research and data literacy. As such, they needed more exposure to a range of data collection and analysis processes in order to make more nuanced choices regarding their learning and teaching decisions; 2) it was evident that while the PST could identify procedures to collect and analyze data in order to demonstrate POOL, they needed more explicit training in how to write up their research findings; and 3) the survey will need to be re-designed to drill down into the three emerging categories (research questions) to gain a more in-depth understanding of why the PST selected particular data sources and data visualizations. Hence, in future iterations of the one week intensive it should be considered that the PST need more exposure to a range of data collection methods. This is so that they have a deeper understanding of why one data collection method or visualization may afford the audience a better understanding of the data.

Conclusion

There are several limitations to this study. There is only a small body of literature on data literacy in initial teacher education and much of the literature is descriptive. We are developing a theoretical understanding of data literacy, and, in this sense, the research may seem nascent. Given that this was a small-scale study that focused on a descriptive analysis, the authors would be hesitant to put forward generalizations about the findings. Further iterations of the study are planned for the coming years to add substance to our claims. However, when taken in the context of larger bodies of work on action research and in-service teachers' data literacy, the findings support the need to have explicit instruction in initial teacher education programs in order to develop much needed classroom data literacy skills.

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Appendix A: Action Research Survey

First name:	
Course:	
Research Question/s:	
Year group/Stage:	
Subject/KLA:	

Please answer the following questions about your data collection and analysis. Note that there is no “correct” answer. We would like to know about how you did your research

1. What is action research?	
2. Describe your action research project and why you selected this area for investigation. (i.e. what did you do, how did you plan it, and why did you investigate this area)	
3. Describe your perceptions of the teacher role as related to action research. (i.e. how did you see your role as teacher and researcher)	
4. Describe how you measured if your action research had an impact upon the classroom (learning, behavior etc.). (i.e. how do you know if it worked)	
5. What was the main topic of your research?	a. Gifted education b. Learning difficulties

	<ul style="list-style-type: none"> c. Communication d. Differentiation e. Assessment f. Behavior management g. Other (please specify)
6. What data collection techniques did you use to collect your data? (You may circle more than one answer)	<ul style="list-style-type: none"> a. Survey b. Observations c. Interview d. Work samples (tests, student work) e. Other (please specify)
7. Why did you select that/those data collection technique/s?	
8. How did you analyze your data? (i.e. what did you do to make sense of your data?)	
9. How did you represent your data in your findings? (i.e. how did you show what you found?)	<ul style="list-style-type: none"> a. Table (numerical e.g. percentages or numbers)) b. Table (text) c. Pie chart or graph d. Text description e. Other (please specify)
10. Why did you represent your data in this form?	

11. What do need to know more about in relation to data collection and analysis to support your research?	
12. Describe the challenges and benefits of doing action research as a teacher in a classroom.	
13. Describe the impact of the action research on your own teaching practices as related to their participation in the action research. (i.e. how did the action research affect your teaching – if it didn't and why)	
14. As a pre-service teacher, what are your thoughts on action research assessments during practicum? (i.e. good, bad, how they can be improved)	
15. Any closing thoughts?	

COUPLING PHET SIMULATIONS AND POGIL: HIGH SCHOOL CHEMISTRY STUDENTS' LEARNING AND ENGAGEMENT IN ARGUMENTATION ON THE TOPIC OF ATOMIC THEORY

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Abstract POGIL – Process Oriented Guided Inquiry Learning – is a tested curriculum utilizing graphs, data tables, and illustrations presented in such a way as to prompt the students to discover the patterns and underlying rules of science. PhET is a group of internet-based simulations created by the University of Colorado that are used to teach select chemistry concepts. Guided inquiry worksheets prepared for use with these simulations allow students to discover the patterns and underlying rules of science. While these two platforms have been researched, the use of them in combination in a class has not been studied. This article examines the use of these two platforms in combination to teach the concept of atomic structure to high school chemistry students. Students completed a pre-test and post-test as well as several opinion surveys about the classroom activities. Observations of the students' actions by the teacher were also recorded. At the conclusion of the study, students showed a significant improvement on the post-test, and the number of times students were seen explaining multiple representations to their partner or team and arguing their position increased with each activity. The combination of POGIL and PhET guided-inquiry activities in this high school classroom was shown to successfully help students learn and use several science practices advocated by NGSS.

Keywords: teacher action research, simulations, guided inquiry, multiple representations, high school chemistry, POGIL, PhET

Introduction

When learning abstract concepts, a picture is truly 'worth a thousand words' (Barnard, 1921). Representations—tools for representing knowledge—help students understand

abstract science concepts (Treagust & Tsui, 2014). Representations in chemistry courses help students navigate the abstract understanding of atomic structure and the multiple perspectives (i.e. macroscopic, submicroscopic, and symbolic) from which chemists communicate knowledge about matter (De Jong & Taber, 2007; Williamson & José, 2009). Atomic structure is one of the first abstract concepts of the year in many high school chemistry curricula; and the abstract nature of the topic leads to student struggles. The Process Oriented Guided Inquiry Learning (POGIL) curriculum for high school chemistry (Trout, 2012) includes representations to help students learn about atomic structure through guided inquiry instruction. Several representations to help students understand atomic structure can also be found as simulations among the collections of PhET Interactive Simulations available freely online (PhET, 2018) and, like all the PhET simulations, are designed to be used as guided-inquiry activities (Moore et al., 2014). While each instructional strategy has been studied independently, the use of these two approaches together to help students learn has not been studied. The strategies together could provide students with multiple representations of the structure of atoms, ions and isotopes. Multiple representations give the students options when forming their own mental models to help them learn (Schwonke, 2009). In this article, we described the results of an action research study that combined POGIL activities and PhET simulations in guided inquiry activities to deliver instruction on atomic structure to high school chemistry students. It was hoped that by combining new representations of atoms, isotopes and ions in a guided inquiry, cooperative learning environment, high school students would help each other integrate the new representations into their knowledge base and learn about atomic structure while using science practices.

Literature Review

Multiple representations. Many studies have been done on the efficacy of using multiple representations to learn chemistry. Common representations include text, images, graphs, equations, symbols, tables, diagrams, lists and animations. Students prefer pictures and animations when learning abstract concepts (Yesildag Hasancebi & Günel, 2013). When students endeavor to learn new concepts, providing multiple representations of the material can be beneficial to the process. According to Schwonke (2009) the benefits can be broken down into three categories:

Firstly, multiple representations may provide different information or stimulate different learning activities (complementary function). Secondly, known or easy-to-understand representations can facilitate the interpretation of others (constraining function). Finally, multiple representations can support deeper understanding, when information distributed over different representations is integrated (construction function) (p. 1227).

However, students have to make the connections between the representations themselves which can be challenging (Rau, 2015; Walldrip, Prain, & Carolan, 2010). Because not all students learn in the same manner, it is generally better to provide more than one representation of the material to be learned (Rose & Gravel, 2011). This gives the student options. They may relate to one type of representation more than another. Because knowledge is constructed in the mind of the learner, (Bodner, 1986) learners need to draw upon prior knowledge to build these connections. Learning to build bridges connecting

these different representations is also a significant challenge for some students, especially novice learners with low prior knowledge (Corradi, Elen, & Clarebout, 2012). Guided-inquiry in cooperative groups may hold the key to solving this conundrum.

Guided Inquiry. During guided-inquiry activities, which are sometimes referred to as teacher-initiated activities (Llewellyn, 2013), students explore teacher-generated questions or prompts. In experiments students might be guided by a single question, but it can be more. In guided inquiry, while students are given the questions, they are not given the procedures for answering the questions or the methods for analyzing data or communicating their results (Bell, Smetana, & Binns, 2005; Llewellyn, 2013). While the teacher facilitates the students' procedures and analysis, he/she does not provide the answers. As with other forms of inquiry instruction, guided-inquiry requires students to take ownership of their learning and is aligned with research on how students learn (Crawford, 2014; Llewellyn, 2013). Research into student learning has demonstrated that guided inquiry is an effective method for helping students learn (e.g. Crawford, 2014; Spencer, 2006)

POGIL. POGIL is a student-centered, guided learning experience where students work in small groups to complete specially designed activities. The activities promote active engagement and group learning following a learning cycle paradigm (Moog et al., 2006). The learning cycle used in POGIL activities is an inquiry strategy for teaching and learning that is based on constructivist principles (Moog et al., 2006). Initially, learners explore a model or some given piece of information that may encompass multiple representations of the information to be considered. Once the students have attempted to explain or understand the patterns in the given model, terms are introduced so that the students have a concept to which to tie them. The last step is the application phase where students apply their new learning using a series of deductive reasoning steps. The focus is on the process as much as the content (Moog et al., 2006). POGIL activities employ multiple representations of the material in a process that allows the students to draw connections between them.

POGIL are designed to be executed in cooperative groups that allow the students to interact in their assigned roles to achieve the goal. Cooperative learning structure allows students to use three important elements: (a) discussion among students, (b) problem solving, and (c) verbalization of methods and strategies (Cooper, 1995). Through the use of effective discourse, the students assist one another in the acquisition of the concepts. As students work in cooperative groups, instructors are facilitators not lecturers, listening to student discourse and providing guidance as needed.

Many studies have shown the effectiveness of POGIL, including higher course grade achievement as well as lowered attrition rate in college level chemistry courses (Moog et al., 2006). Additionally, when using POGIL, Spencer (2006) found that the greatest gains in course grade were seen in the lower half of the class. These increases may be attributed to greater student buy-in because the students are more actively involved in the learning process.

PhET. PhET is a multimodal tool that students can use to make concrete connections between the abstract and un-seeable, subatomic particles (Moore et al., 2014; also find simulations at <https://phet.colorado.edu/>). PhET simulations present content in an

interactive computer interface that allows the students to “play” with the content to try to draw their own conclusions as to how it works. These simulations use multiple representations ranging from the animation itself to supporting tables, graphs, and other visualizations of the data. The ease of use and the draw of a video game brings “even the most reluctant learners” (Sandoval, 2011, p. 46) into the game.

Developers of PhET simulations designed them to be performed by single students or in pairs (Moore et al., 2014). More than two students at a computer is not optimal for student learning due to space constraints. If the PhET is performed by a pair of students, the opportunity for student discourse is present, allowing for discussions that may lead to a deeper understanding of the activity and its goal. PhET simulations “provide a range of opportunities for conceptually rich, student centered activities and discussions” (Moore et al., 2014, p. 1194). PhET simulations were developed with implicit scaffolding to guide students through the use of the simulations for learning (Moore et al., 2013), making them good for guided inquiry activities with light guidance (Chamberlain et al., 2014). Most of the simulations found on the PhET website have teacher-generated guided-inquiry activities which could be used with the simulation (PhET, 2018).

The efficacy of PhET use in classrooms is well supported by several studies. Wickham (2016) found that, “The constructionist capability of the PhET microworld was a significant factor in the improvement of participants’ affective engagement” (p. 38). Ajredini (2014) found that when compared to real experiments, students working in the simulation group spent more time thinking, analyzing and discussing the concepts, while students working on the real experiment spent more time solving technical difficulties.

Methodology

Purpose of Study. POGIL and PhET have both been found to be effective for helping students acquire difficult concepts, but their use has not been studied in combination. With their similar approaches they could be complementary. We wanted to know the efficacy of using POGIL activities along with guided-inquiry activities using PhET simulations to teach high school chemistry students about the structure of atoms, isotopes and ions. Not only did we want to know if students learned using the activities, but we wanted to know students’ opinions of the activities and how they engaged with the representations in the activities during class. The following questions guided this study:

1. Does students’ knowledge about basic atomic structure, including isotope and ion structure improve when coupling PhET simulations with POGIL?
2. How do students engage with each other and with the multiple representations of atomic structure that they encounter during each activity?
3. Do students’ preferences for guided inquiry process using a computer simulation (PhET) or guided inquiry process using POGIL result in a statistically significant difference in scores on the common post-test?

This classroom action research study sought to determine if combining guided inquiry learning through PhET and POGIL worksheets would increase students’ scores on a post-test. It was also designed to examine how students used multiple representations to build understanding of abstract concepts. Lastly, this research sought to draw connections

between the students' learning and their preferred guided inquiry format, either PhET or POGIL.

Population and Environment. This study was conducted at an eastern United States high school (MHS). MHS has a population of 1556 students who are 38.7% White, 25.4% Hispanic, 22.9% Black, 8.0% Asian, and 4.9% Other. Fifty one percent (51.4%) of students receive free or reduced meals, 12.0% are in the special education program, and 3.8% are in the ELL program.

Students from the first author's two honors chemistry courses (N =33) participated in this study. The majority of the students were in their junior year, but 2 sophomores in an accelerated science pathway were also enrolled in the study (representing 6% of students enrolled). Although two separate classes were used, all activities, surveys and tests were given on the same days for both classes. Groups for each activity were determined by alphabetical listing and did not change for the two types of activities. The groups of two for the PhET activities were the same, as were the groups of three for the POGIL activities.

Atomic Structure Unit. The students in honors chemistry completed a pre-test of their level of understanding of the concepts at the start of the unit. On Day 1, the students then completed the PhET Build an Atom Lab (PhET, 2018) with a partner. The next day, the POGIL Isotopes worksheet (Trout, 2012) was completed in teams of three. The second PhET activity, Isotopes and Atomic Mass Lab (PhET, 2018), was completed in pairs on Day 3. The last activity, POGIL Ions worksheet (Trout, 2012), was completed in teams of three on Day 4. Excluding Day 1, after each activity students completed a survey described below. After the four activities were completed (Day 5 of the unit), an unannounced post-test was administered to the students, and they completed one final survey. Three weeks later, the students took a unit test covering the topics in this study.

Data Collection. The nature of the three research questions above required a research plan, approved by the Institutional Review Board (IRB), that collected both qualitative and quantitative data to answer the different questions. After each activity (except the first PhET simulation) and at the end of the atomic structure unit, students self-reported on a survey their likes and dislikes and how they used the multiple representations presented in the two processes (POGIL and PhET) using Likert style and open-ended questions (See Appendix A and B for Survey Questions). The main question the students were asked was, "How did you use the different pictures, diagrams, symbols and tables to aid your understanding of the concepts covered in this activity?" In addition, the first author monitored the students' learning process, using descriptive notes and tally sheets. The tally sheet categories used were: Collaborating with Partner/Team, Explaining Multiple Representations to Partner/Team, and Arguing His/Her Position. Any time the first author saw a student doing one of the actions listed on the tally sheet, she marked next to a student's name. A pre-test and a post-test were designed to ascertain the effectiveness of each process using a two-tier multiple-choice instrument (Treagust, 1988). For each concept, students were asked

true/false questions and then were required to explain the reason(s) for their choice. For example, “T / F Neutrons have a negative charge. Reason(s)” (See Appendix C for the complete test). The test was designed by the first author and reviewed for accuracy and clarity by the second author and another experienced chemistry teacher. Students received a score for their answer to the true/false part of the question and for their reasons separately. They could get points for answering the true/false correctly even if they did not provide a reason.

Data Analysis. Several methods of analysis were used with the collected data to help answer the research questions. After grading the pre and post-tests, along with collecting descriptive statistics, *paired sample t-tests* were run (Creswell, 2012). In addition, qualitative data from the common survey question, “How did you use the different pictures, diagrams, symbols and tables to aid your understanding of the concepts covered in this activity?” (Survey 1 question 7, Survey 2 question 7, and Survey 3 question 6), was coded and students’ responses were placed into one of 7 categories. Table 1 provides the categories, a brief definition of the category, and a sample student response.

Table 1: Categories of Student Responses to How They Used the Representations in the Activities Question

Response Category	Definition of Category Student’s Response Described....	Example Student Response
Pictures/Visuals	How the visuals aided their learning	“I took information from visual aids on the paper (POGIL) and interpreted them in a way so that I could comprehend them through comparison to other isotope sets.”
Place on the Periodic Table	Made reference to the periodic table	“The use of the periodic table helps me understand the concepts because this diagram shows all the info we learned throughout this process. It’s cool how it is all coordinated on a diagram.”
Comparisons/Patterns	Mentioned a pattern or made a comparison	“I was able to see what was going on and how it changes or stays the same.”
Didn’t Use/Not Helpful	Started with “No”	“No, I was still confused and did not know what to do.”
Used No Explanation	Started with “Yes” with no explanation provided	“Yes”

Used to Resolve Confusion	Using the representations to clear up a misunderstanding	"They helped me understand how many protons, neutrons and electrons are in an element."
No answer	Did not answer the question	

Data collected from the tally sheets was compiled by category (Collaborating with Partner/Team, Explaining Multiple Representations to Partner/Team, and Arguing His/Her Position) and compared across the four activities. Students' preferences for PhET or POGIL were determined based on their answer to the ranking questions on the final survey, higher number was preferred. Students' rankings for the PhET activities and POGIL activities were added together to determine which they preferred, and they were assigned to a preference group. Then *one-way ANOVA* was run to determine if there was a difference in performance on the post-test based on preference.

Results

Statistical analyses were performed on the pre-test and post-test data, showing the percent improvement of each student and the entire set of students; the standard deviations were calculated as well. Based on the variety of student responses to questions 26, 29 and 30, these questions were not clear. The mean for the pre-test was 55.9% and the mean for the post-test was 89.7% (Figure 1). A paired sample t-test was run to determine if the four activities were effective at raising student scores on the post-test. The mean score improvement ($M=33.75$, $SD=11.91$, $N=33$) was significantly greater than zero [$t(32)=-16.28$, $p < 0.01$] providing evidence that coupling PhET simulations with POGIL exercises helped students learn the topic of atomic theory. Three weeks after the post-test was administered, the students were given a unit test that included questions covering the topics in the study. Though a 1% improvement in the total score for the unit test from the post test, a t-test indicated no significant difference in students' post-test and unit test scores [$t(32)=-0.503$, $p = 0.618$], indicating that information had been retained.

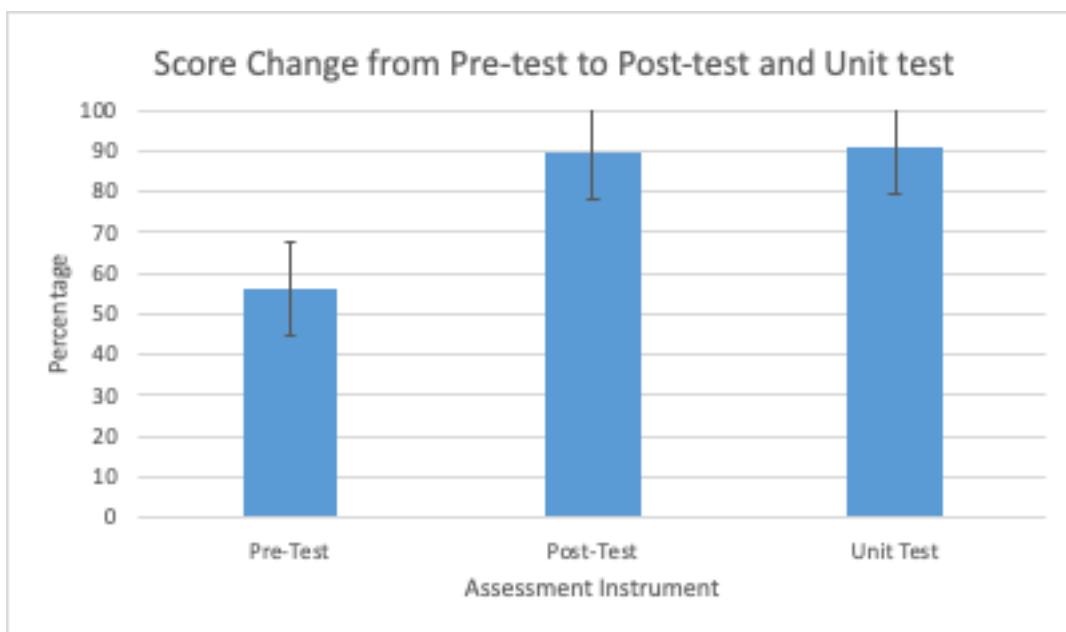


Figure 1: Student Scores on a Pretest, Post-test and Unit test 3 weeks later.

Students were surveyed after each activity as to how they used multiple representations to aid their learning. The data in Figure 2 below were compiled by combining these data from the two POGIL activities (POGIL Isotopes and POGIL Ions) and from the survey administered after one PhET activity (PhET Isotopes).

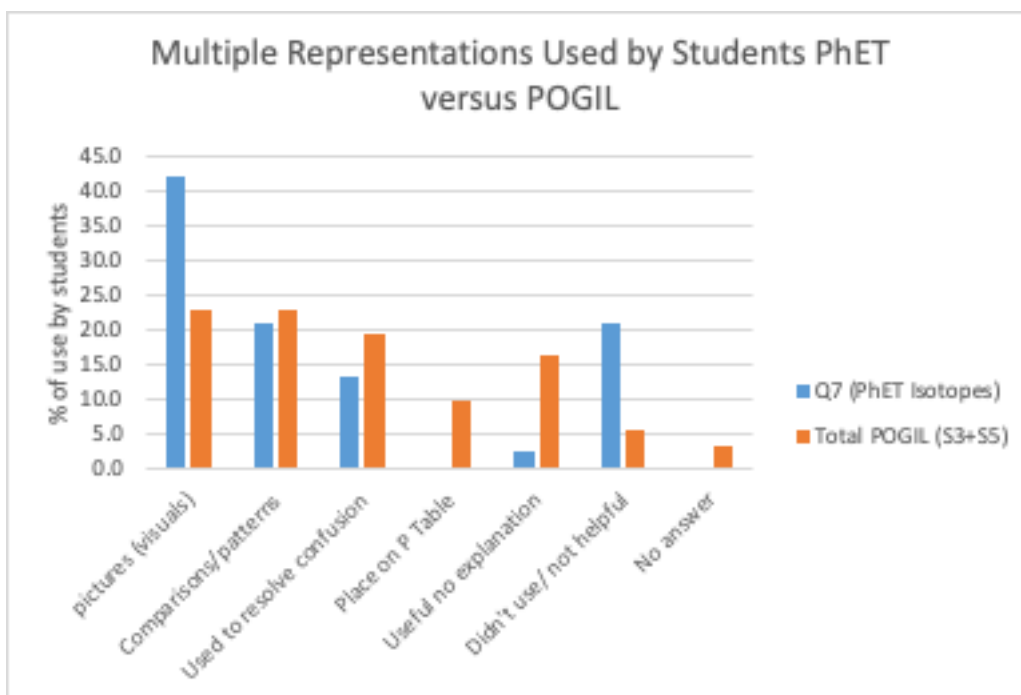


Figure 2: Multiple Representations Used by Students – PhET versus POGIL. This figure illustrates the side by side comparison of student reported use of multiple representations for both the POGIL (orange) and PhET (blue) activities.

Students reported using more types of multiple representations while completing the POGIL activities, with only 5.4% reporting that they did not use the multiple representations, or they felt they were not helpful to their understanding. Students reported using fewer types of multiple representations for the PhET activity, with 21.1% reporting that they did not use any multiple representations, or they felt they were not helpful. During the PhET activity students' responses focused on the pictures or visuals.

The first author's observations through tally sheets showed that 100% of students participated in each of the four activities. With each activity, PhET or POGIL, students using multiple representations to explain concepts to their group or partner increased, but a dip was seen in the arguing position data for the PhET Isotopes activity (See Figure 3).

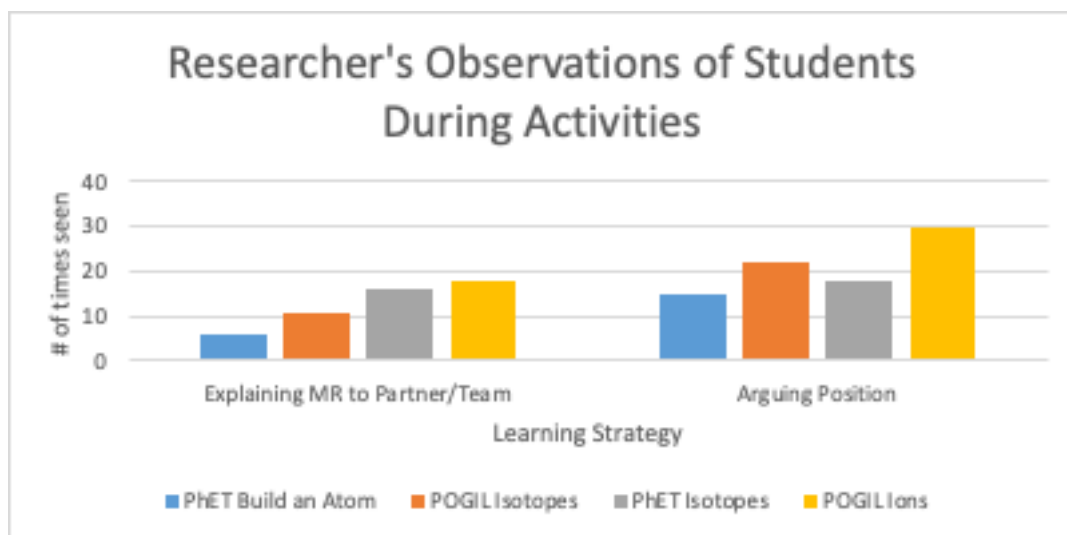


Figure 3: Researcher's Observations of Students During Activities. This graph shows that the number of times students were seen explaining multiple representations to their partner or team and arguing their position increased with each activity.

Along with tally marks, the observation sheets were also used to keep some field notes on students. In the first activity, PhET Build an Atom, the students quickly engaged each other in conversation about the activity. This topic was not new to them and they easily completed the task, helping each other recall the information they had seen two years prior. The active discussions helping each other understand the material continued for the second activity, POGIL Isotopes. One student described in her reflection on the activity what was observed for many students, "We used the periodic table to look for elements and atomic numbers, and we referenced the diagram on the POGIL to understand atomic number and how isotopes are written." She also commented that, "I like how we work in groups to complete these activities, and I think that they're challenging in a good way." Observations of students' behavior, on task, actively working with each other, suggest that many students agreed with her statement.

During the third activity, PhET Isotopes, the students seemed confused by the online simulation. Their conversations were more tentative, asking for confirmation of their ideas rather than stating them. One student said in class, "It always stays the same?" – referring to the number of protons in an isotope, but asking as a question rather than stating to his partner. The students appeared to lack confidence enough in their understanding to come out in favor of their ideas. Fewer instances of students arguing their position was seen with the PhET Isotopes activity than either of the POGIL activities.

From the observations sheets, as seen in Figure 3, students most effectively combined the use of multiple representations during the last activity, POGIL Ions. One student was observed explaining to his partner, using POGIL Ions Model 1 from the activity worksheet and the periodic table on the classroom wall, "You can predict charge because there's a pattern using the number of valence electrons." That same student wrote in his POGIL Ions reflection that, "I analyzed the pictures, diagrams and isotopic symbols to find the right

answer.” Another pair of students, completing the POGIL Ions activity, helped each other understand how to find the charge of an ion by using an algebraic equation. One student was explaining to her partner that “you subtract the electrons from the protons to get the charge.” Her partner responded by writing down “ $x - y = \text{charge}$ ” to which she said, “Yes, exactly!” The partner wrote in her POGIL Ions reflection that, “Filling in the table (question 7) helped me better understand because you have to use what you already know to fill it out.”

When combined together, the interactions between the students was higher when they were completing a POGIL activity than when they were completing a PhET activity. (Figure 4)

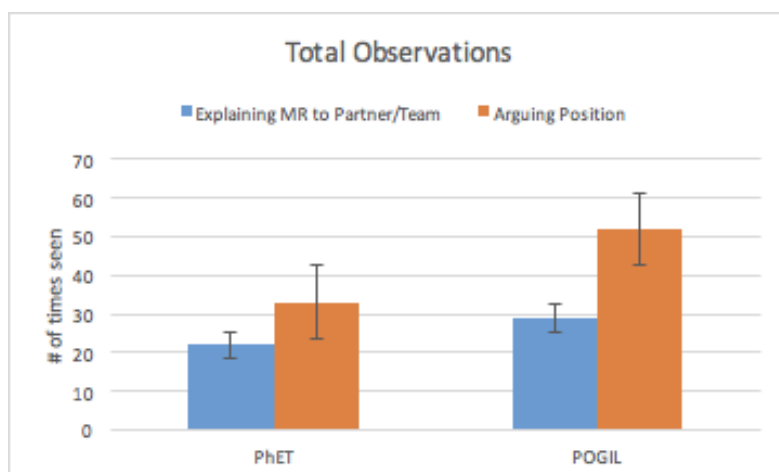


Figure 4: Total Number of Observations of Student Behaviors seen during PhET activities versus POGIL activities

The students were surveyed after each activity, soliciting their feelings about how much each activity aided their understanding of the concepts presented. The questions were specific to different concepts about atomic structure and their understanding (See Appendix A and B for survey questions). The students’ scores for all these understanding questions was averaged to give a score for how they rated the activity in aiding their understanding. Students reported gaining more understanding from the POGIL activities than the PhET activity (See Figure 5).

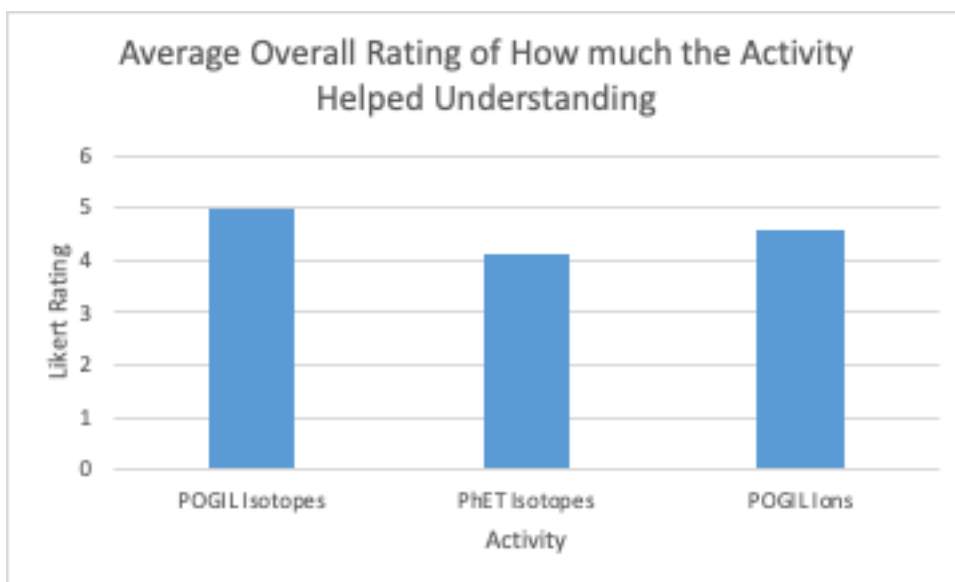


Figure 5: Students' average overall rating of how much each activity helped them understand, a 6 represents strongly agree with the statement.

At the conclusion of the study the students ranked the four activities with respect to their personal like or dislike of the activity, with a 4 being the activity they liked the best. By adding together students' scores for the PhET activities and for the POGIL activity, a total rating for each type of activity was created. Four students misunderstood the directions and ranked all four activities equally. This data was omitted. Of the 29 remaining students, 3 preferred POGIL, 2 liked PhET and POGIL equally, and 24 preferred the PhET simulation. The PhET Build an Atom activity was chosen as the favorite by 20 out of 29 students, making it overwhelmingly the favorite activity in the study. A paired sample t-test was run to determine if the student preference was significant. The mean preference score ($M=2.76$, $SD=2.73$, $N=29$) was significantly greater than zero [$t(28)=7.32$, $p<0.01$], providing evidence that the students preferred PhET to POGIL to support their learning of atomic structure.

Individual student improvement was compared to reported student preference for PhET or POGIL using *one-way ANOVA* to see if their means are statistically different. The results showed that the groups were not different statistically ($f=0.663$, $p=.514$). There was not a statistical difference in student performance based on their preference for PhET or POGIL.

Limitations

The validity of this study is limited by several factors. The sample size of 33 students from one high school is small and includes some level of bias. Although the students were sampled from a diverse high school, only students in the honors level were invited to participate. In addition, a survey was only given after one of the PhET simulations, not both. It was not given after the first PhET activity. While they ranked this activity in their final survey, they did not have the chance to give feedback on it directly. While the PhET and POGIL activities used covered similar topics on the concept of atomic structure, they were

not 100 percent aligned to each other, and did not present exactly the same material. There was no control group to compare, so students learned but it could just be a result of instruction of any type, not necessarily the guided-inquiry. Additionally, the survey results may have been affected by over use of the questions. Because the students saw the same question on each survey asking how they used the different pictures and diagrams, they may have inferred the purpose of the study and engaged with the representations differently than they would have without the study.

Discussion

Combining the Guided-Inquiry Platforms Increased Post-Test Scores. The mean student performance on the post-test improved by 33.8 points from pre-test levels. This statistically significant result supports the hypothesis that students learned during this instructional sequence which combined PhET and POGIL activities in a unit on atomic structure. Student retention of the concepts was evident from the unit test scores as well. Students were tested three weeks after the post-test and improved 1% over the post-test levels showing retention of the material. The results also showed that the student's post-test score increased regardless of their preference for either PhET or POGIL. These results suggest that POGIL and PhET can be used together in classes to help students learn. They do not appear to confuse students or contradict each other when used in combination.

Students Use of Multiple Representations and Reported Preference. Students reported using multiple representations more often with the POGIL activities than with the PhET activity (Figure 2) and reported understanding the content better with the POGIL activities (Figure 5), yet they preferred the PhET activities to POGIL. Observations also showed that students were more active in explaining the multiple representations and arguing their position when completing the POGIL activities (Figure 4). These findings could be a result of students becoming more familiar with their groups over time or from the clarity of the activities themselves. However, the students reported a preference for the PhET activities. If they were confusing it would be unlikely that they liked them. In addition, even though they liked the PhET better, they were more actively engaged while completing the POGIL activities, even the first of the POGILs. Students stated that they liked the PhET activities better because they were “interactive” and “easier to understand”, while the POGIL activities were “a bit boring”. Comments taken from the student surveys suggest that the students liked the PhET activities and felt they were easier to understand because they were more visual. Student comments included:

- I think the online programs helped the best because we could play around with them and experiment on our own.
- I think that the activities where I could use the mousepad to move protons, neutrons, and electrons were most useful for me as a visual learner.
- Both of the PhET's were very helpful in visualizing the changes made from adding protons, neutrons and electrons. The POGIL's were good too, but didn't help as much to visualize everything.
- I liked the PhET's better than the POGIL's because it was more interactive than just seeing everything on paper. I like the step by step process (of POGIL) but still prefer the interactive interface (of PhET).

Given the design principles behind the PhET simulations (Moore et al., 2014), it is not surprising the students found the PhET simulations interactive and visual; they were designed to be. The use of this type of visualizations is important for student learning of the multiple levels of chemistry (De Jong & Taber, 2007; Williamson & José, 2009), and enthusiasm and active engagement in activities for learning also improves student learning (NRC, 2004). But while the students have a preference for the PhET activities, they did not hate the POGIL activities and, in fact, rated them higher in helping them understand the content. One student's comment sums up this idea: "I liked this activity (POGIL Isotopes) because it broke things down step by step which made it easier to understand. But I preferred PhET overall because they were more interactive." Thus, POGIL and PhET activities might be complementary in another way of improving the engagement and visualization while providing clarity to the content.

Three-dimensional learning emphasized in the Next Generation Science Standards (NGSS) asks teachers to engage students in scientific practices while learning core ideas (NGSS Lead States, 2013). The scientific practices (SEPs) K-12 students are expected to engage in while they learn science include, among other things, constructing explanations, engaging in argument from evidence, and evaluating and communication information (NGSS Lead States, 2013; NRC, 2012). In our study, overall, student use of multiple representations to explain concepts to their partners or argue their position increased with each activity; they were engaging in these SEPs with each other in their groups and showing greater use of the skill as they learned about atomic structure. The improvement over the course of the activities may be due to the students becoming more comfortable with their partners/group or the order in which the activities were presented. POGIL activities are designed for collaborative groups (Moog et al., 2006) and rely upon student discourse and interaction for successful completion. The students in this study had completed one previous POGIL activity in the class prior to the study, so were familiar with the process, which might explain the initially higher level of observed interactions between group members for the POGIL activities. Students were unfamiliar with the PhET platform prior to these activities and the PhET activity may have required less student-to-student discourse, but their discourse did increase with the two activities. Thus, the use of both activities gave them informal practice with SEPs. In addition, many students reported a preference for working in teams to accomplish goals. In the comments, students stated:

- I enjoyed the group project aspect as I learn better by asking questions of my peers and by comparing information.
- I liked it (cooperative group work) because I learned by finding stuff out with classmates.
- I like how we work in groups to complete the activities, and I think that they're challenging in a good way.

Not only were students engaged in scientific practices, but cooperative learning has also been shown to be effective in helping students learn (Cooper, 1995) and communication with others is an important part of learning according to the constructivist theory of learning (Bodner, 1986).

Implications

Students in this study learned about basic atomic structure, used multiple representations of atoms to help them understand the content, and engaged in explanations and argumentations with their classmates when POGIL and guided-inquiry PhET simulation activities were used together. It is likely that the guided-inquiry design of these materials, along with the cooperative nature of the POGIL activity and the visual, interactive nature of the PhET simulation activities, supported students' learning. The alternating nature of the activities in this unit may be an effective way of obtaining the learning outcomes shown in prior research (e.g. Chamberlain et al., 2014; Spencer, 2006) of POGIL and PhET together and should be explored by other educators in their classrooms. Along with support from learning theory (e.g. Bodner, 1986) and the quantitative findings, the students' comments from the surveys also imply the cooperative nature (group aspects) of the activities were important parts of the successful learning for students and should be maintained by teachers if they implement these activities in their classes.

Conclusion

This was a small initial study. More research is needed to support the findings that the activities support student learning on other topics, not just atomic structure. In addition, research into how the combination of POGIL and PhET might alter student understanding through a deeper look at student reasoning, needs to be examined. Finally, in light of NGSS, a closer look at the quality of students' arguments and scientific explanations, the SEPs they used in these activities, is needed to see how they can be leveraged to continue to improve students' skills in these areas. Nevertheless, this study provides evidence to encourage high school teachers to incorporate POGIL and PhET guided-inquiry activities in their classrooms regardless of student preference.

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Appendix A: Survey Questions Following Each Activity

1. This worksheet helped me to better understand the role of a **proton** in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

2. This worksheet helped me to better understand the role of a **neutron** in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
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Why do you feel this way?

3. This worksheet helped me to better understand the role of an **electron** in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

4. This worksheet helped me to better understand what makes up the mass of an atom.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

5. This worksheet helped me to better understand what an isotope is.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

6. This worksheet helped me to better understand how to write an isotopic symbol.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

7. How did you use the different pictures, diagrams, symbols, and tables to aid your understanding of the concepts covered in this activity?
8. What are your thoughts and feelings about this activity? Likes? Dislikes?

Appendix B: Final Survey Questions

1. I feel confident that I understand the role of a proton in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
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Why do you feel this way?

2. I feel confident that I understand the role of a neutron in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

3. I feel confident that I understand the role of an electron in atomic structure.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

4. I feel confident that I understand what makes up the mass of an atom.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

5. I feel confident that I understand what an isotope is.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

6. I feel confident that I understand what an ion is.

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
-------------------	----------	-------------------	----------------	-------	----------------

Why do you feel this way?

7. How did you use the different pictures, diagrams, symbols, and tables to aid your understanding of the concepts covered in this activity?

8. Were there any particular pictures, diagrams, symbols, and/or tables that you felt helped your learning? Which one(s)? Why do you think they were helpful?

9. Rank how much you liked the four class activities we did.

1=liked the best, 4=liked the least

_____ PhET Build an Atom

_____ POGIL Isotopes

_____ PhET Isotopes and Atomic Mass

_____ POGIL Ions

10. How do you feel about these four activities? Likes? Dislikes? Explain your reasons for the ranking you gave in question 9.

11. Do you feel that one particular activity helped you learn more than the others? If yes, name it.

Appendix C: Atoms Pre and Post Test

For each question, circle the letter for **True** or **False**. Then explain your reason(s) for your choice.

1	T / F	Protons are found in the nucleus of the atom.
	Reason(s)	

2	T / F	Protons are NOT found in the nucleus of the atom.
	Reason(s)	

3	T / F	Electrons are found in the nucleus of the atom.
	Reason(s)	

4	T / F	Electrons are NOT found in the nucleus of the atom.
	Reason(s)	

5	T / F	Neutrons are found in the nucleus of the atom.
	Reason(s)	

6	T / F	Neutrons are NOT found in the nucleus of the atom.
	Reason(s)	

7	T / F	Protons have a positive charge.
	Reason(s)	

8	T / F	Protons have a negative charge.
	Reason(s)	

9	T / F	Protons are neutral (they have no charge).
	Reason(s)	

10	T / F	Electrons have a positive charge.
	Reason(s)	

11	T / F	Electrons have a negative charge.
	Reason(s)	

12	T / F	Electrons are neutral (they have no charge).
	Reason(s)	

	T / F	Neutrons have a positive charge.
--	-------	----------------------------------

13	Reason(s)	
----	-----------	--

14	T / F	Neutrons have a negative charge.
	Reason(s)	

15	T / F	Neutrons are neutral (they have no charge).
	Reason(s)	

16	T / F	Protons have a mass of 1 amu.
	Reason(s)	

17	T / F	Protons have insignificant mass.
	Reason(s)	

18	T / F	Electrons have a mass of 1 amu.
	Reason(s)	

	T / F	Electrons have insignificant mass.
--	-------	------------------------------------

19	Reason(s)	
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20	T / F	Neutrons have a mass of 1 amu.
	Reason(s)	

21	T / F	Neutrons have insignificant mass.
	Reason(s)	

22	T / F	You calculate atomic mass by adding the number of protons and the number of electrons.
	Reason(s)	

23	T / F	You calculate atomic mass by adding the number of protons and the number of neutrons.
	Reason(s)	

24	T / F	You calculate atomic mass by adding the number of electrons and the number of neutrons.
	Reason(s)	

25	T / F	Isotopes of an element have a different number of protons.
	Reason(s)	

26	T / F	Isotopes of an element have a different number of electrons.
	Reason(s)	

27	T / F	Isotopes of an element have a different number of neutrons.
	Reason(s)	

28	T / F	An ion has different numbers of protons and electrons.
	Reason(s)	

29	T / F	An ion has different numbers of protons and neutrons.
	Reason(s)	

30	T / F	An ion has different numbers of electrons and neutrons.
	Reason(s)	

USING BIBLIOTHERAPY AND PERSONAL REFLECTION AS TOOLS FOR REDUCING MATH ANXIETY

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Abstract This study shares an action research project in a high school located in South Florida addressing mathematics anxiety reduction with 9th grade students starting high school in an Intensive Math and Reading class with a Special Education teacher using a Math Anxiety Reduction protocol based on sound research. The paper shares the need, the research, the protocol, an analysis, and suggestions for teachers and schools so to address math anxiety so to build confidence.

Keywords: teacher action research, mathematics anxiety, high school, bibliotherapy, mathematics anxiety reduction

Introduction

Children don't hate math. What they hate is being confused, intimidated, and embarrassed by math. With understanding comes passion, and with passion comes growth – a treasure is unlocked.

-Larry Martinek, Founder of Mathnasium

Honest self-reflection opens your mind to reprogramming, change, success and freedom.

-Unknown

The student's essay was quite clear regarding their feelings about mathematics, "I am in Algebra I and I do not like it. It is the second semester and I have a better grade, but still hate math." Unfortunately, this is all too common in school classrooms today, especially for those students who have struggled with mathematics throughout their elementary and middle school years. Students who face this deficit may be limiting their opportunities for college and career choices. There is a need for students entering high school to have support that focuses on building mathematics skills and addressing mathematics anxiety. We are in a world that is increasingly being driven by technology and communication where employers are now listing flexible, empowered, strategic, curious, and innovative as preferred skills. Globally, the international tests indicate that American students still fall short when compared to student performance in other countries. The Organization for Economic Cooperation and Development (OECD) released the latest Programme for International Students Assessment (PISA) results from 2015. In mathematics, the United States' mean score was 470, which is 20 points below the OECD mean score of 490 (Kang, 2016; OECD, 2018).

The purpose of this action research project was to better understand why students continue to struggle with high school level mathematics, particularly algebra, to understand the role that mathematics anxiety may play in their quantitative development, and to make recommendations to inform teachers' instruction. An action research project was used to obtain information in an effort to change classroom practices to better aid students in learning math. Higgins (2013) found that mathematics teachers working together, sharing a common purpose and working towards a goal will have a bigger impact on student learning and success. Fraenkel, Wallen, and Hyun (2015) write that "practical action research is intended to address a specific problem within a classroom, school or other 'community...Its primary purpose is to improve practice in the short term as well as inform larger issues" (p. 588). The guiding question used throughout the project was, "How can the use of bibliotherapy, writing, and personal reflection activities help students reduce math anxiety?"

This project envisioned by the Professional Development Professor, Principal, and ESE Teacher is in line with work by Venables (2014) on how teachers can turn data and results into action research to assist them in understanding student success rates at the school, "In all cases, our ultimate purpose in reviewing and responding to data is to improve some aspect of our students' learning" (p. 19). The NCTM (1989) as part of their mathematics *Standards* recommend teachers checking for negative dispositions of their students many decades ago. NCTM then published strategies for addressing math anxiety in 1995 (NCTM) and the Common Core State Standards (CCSS) (National Governors Association, 2010) for Mathematics also concerned with preparing young people for STEM and building math confidence also addressed this concern about math attitudes. Peterson, Barrows, and Gift (2016) also cited the rigor of the new Common Core Math Standards and how important it is for teachers to also address and support the math anxiety when teaching the new standards. Reys, Lindquist, Lambdin, and Smith (2014) have been mathematics educators for decades and recommend that teachers train their students to persist in asking the

teacher to make all mathematics they are teaching clear so that students never feel any anxiety when learning. This is key and really needs to be put into practice in all classrooms.

Literature Review

Math Anxiety is Real. What is math anxiety? Simply put, it is anxiety when confronted with doing math, especially about one's own performance in solving math problems. It can range from slight nervousness to all-out panic. This anxiety makes it more difficult for students to focus in class, learn math, solve math problems, and take tests. Repeatedly students would rather give up than have to face their fear of the subject. This means that they never get better at math and can therefore never overcome their anxiety. Richardson and Suinn (1972) originally defined math anxiety as, "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 551). Mathematics anxiety is the, "irrational dread of mathematics that interferes with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" (Buckley and Ribordy, 1982, p. 1). If this anxiety is not overcome, the student may suffer from this anxiety for their entire life, even beyond their time in school. Math anxiety is a well-documented phenomenon that has affected many cultures for over forty years or more, and not enough is being done to address it in our classrooms or in the way we teach math (Andrews & Brown, 2015; Beilock & Willingham, 2014; Chernoff & Stone, 2014; Dowker, Sarkar, & Looi, 2016; Finlayson, 2014; Furner, 2017a; Furner, 2017b; Furner and Kenney, 2011; Furner, 2004; Furner, 1996; Geist, 2010; Hembree, 1990; Metje, Frank, & Croft, 2007; Rubinsten, Eidlin, Wohl, & Akibli, 2015).

Undesirable attitudes toward mathematics and math anxiety are serious roadblocks for students in all levels of education (Geist, 2010). Beilock and Willingham (2014) state that "Because math anxiety is widespread and tied to poor math skills, we must understand what we can do to alleviate it" (p. 29). If math anxiety is such a problem, one has to wonder why more is not being done about it in our schools today with such an emphasis on STEM. Today, teachers and administrators are discussing project-based learning that will incorporate strategies across the STEM disciplines, and mathematical understanding is crucial to producing a work force that is strong in STEM areas and who can compete globally. (Furner, 2017a). Strong math skills help students with critical decision-making and are essential to successfully completing higher level math and science courses. The importance of this research is to add to the body of literature on math anxiety and to propose strategies and activities that may help students reduce their math anxiety.

Methodology

Qualitative research relies on a "holistic description" of a particular situation, phenomenon, or activity (Fraenkel et al., 2015, p. 426). A defining attribute of qualitative data uses words and rich description, rather than numbers. "Words, especially organized into incidents or stories, have a concrete, vivid, meaningful flavor, that often proves more convincing to a reader...than pages of summarized numbers" (Miles & Huberman, 1994, p. 1). To achieve this level of understanding, qualitative research employs several unique procedures that set

it apart from quantitative research. Some of these characteristics include: the research is done in the natural setting; data collection methods vary, but usually include in-depth interviewing, observations, and document analysis; the research is “emergent” rather than hypothesized; the research is interpretive, seen through the researchers’ personal lens; the process of data analysis focuses on reoccurring themes using “inductive and deductive processes” (Creswell, 2003, p. 183). Qualitative data sources for the action research included recorded class discussions, student assignments, *Mathitudes Survey* (Furner, 2007), and journal entries. Quantitative data was obtained through the use of pre- and post-tests.

The students began the semester by reading the book, “The Math Curse” by Jon Scieszka and Lane Smith (1995). The ESE teacher read and discussed the book, as well as solved the math problems that occurred throughout the story. This led to a discussion about individual student’s feelings toward math. The group discussion allowed the students to share without being judged. Through discussion, many of the students believed that it was their middle school teachers that shaped their feelings toward math. While some said their middle-school teachers created a safe and positive math learning environment, others blamed the teaching style of their teachers as the reason behind their continued math struggles and anxiety.

The discussions were one way to gauge the student’s personal views of themselves as learners of math. The students also shared their views of the benefits and significance of math in society. Many students stated that they did not understand the importance of learning math and did not know what the point was since they would never use higher math in the future. The group brainstormed all of the different ways that math could be used on a daily basis, including possible career paths and the usefulness and importance of math in their daily lives.

The students also were asked to write a “Math Autobiography.” The purpose of the assignment was for each student to reflect on their early experiences with mathematics and to describe how they felt about mathematics. Students were encouraged to describe their attitude toward math. Students could include some of their early experiences with math classes, both positive and negative. Students could explain why they like math or didn’t like math. They were expected to write a five-paragraph essay. While writing, there was open dialogue between the ESE teacher and the students regarding their feelings toward math.

The essay writing assignment took approximately two weeks to complete. During this time, students took a “*Mathitudes Survey*” (See Appendix A, Furner, 2007) and a “Math Anxiety Test.” The *Mathitudes Survey* portions created as part of research, Furner, 1996 and 2007 was created to collect qualitative data on students’ feelings toward mathematics. This survey and test were given to the students for them to gain an understanding of their feelings toward math and for the teacher to be able to identify those who may have math anxiety. Following the essay assignment, several discussions took place with the students. One topic centered on the importance of learning math and ways to help overcome negative feelings toward math. Many students continued to blame their low math ability and their disdain toward math on what they felt was previous teachers’ inadequate teaching. Teaching students to now advocate for themselves when not understanding a

topic was encouraged. The school has built in time within each day of the week for quiet study and tutoring. It was important to teach these students to use this time for getting extra help.

Another discussion was on the topic, “What is Math Anxiety?” The physical and psychological symptoms of math anxiety were discussed. The physical symptoms discussed included: sweating, heart palpitations, nausea, shaking and trembling. Some of the students said they recognized physical symptoms such as shaking, sweating, heart palpitations and nervous feelings in the stomach. The psychological symptoms discussed included: panic and feelings of helplessness, feelings of inadequacy, avoidance and lack of confidence. The students shared their feelings of inadequacy which led to their low confidence.

“Math Myths” gave the students an opportunity to hear some misleading facts about math: 1. You have to be born with a mathematical brain; 2. You can’t be creative and be good at math; 3. Women are not as good at math as men. The ESE teacher shared ways to reduce math anxiety: get plenty of rest, proper nutrition and adequate exercise before a math test, stay positive, keep a journal, seek help when needed, use the internet to research math topics not understood, use resources such as flashcards and playing games that work on core cognitive skills.

The class discussed “The Math Anxiety Bill of Rights.” Some of the “rights” discussed included: I have the right to learn at my own pace and not feel put down or stupid if I’m slower than someone else. I have the right to ask whatever questions I have. I have the right to need extra help. I have the right to ask a teacher or a tutor for help. I have the right to say I don’t understand. I have the right not to understand. I have the right to feel good about myself regardless of my abilities in math (*The Math Anxiety Bill of Rights by Sandra Davis at: <http://www.mathpower.com/>*)

A second book, “Math Rashes and Other Classroom Tales” by Douglas Evans (2002), was read during the class time. Bibliotherapy was used in hopes of connecting students to others with similar math fears and anxieties. Class discussions continued using the characters in the book, relating their own feelings towards math.

A third, and final, book “A Gebra Named Al” by Wendy Isdell (2017) also used bibliotherapy to help reduce the students’ negative feelings toward math and any math anxiety they may have. Focus on the math calculations and math content in the book was left to the Intensive Math teacher.

Math Anxiety Reduction using Bibliotherapy and Reflection Protocol. Participants for the action research project included 6-15 students in a combined Intensive Math and Intensive Reading classroom; the number of students was dependent on the daily rotation between the ESE and math teacher. Students were placed in the intensive classes due to low admission test scores, low standardized tests scores and low math grades from middle school. A few of the students were identified with a math learning disability, some other learning disabilities and Other Health Impairment (OHI) to include Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD). The group of students rotated between an Intensive Math class and an Intensive Reading class, thus, at times there would

be 6 – 8 students in each class. The time spent with students on the research project was 2-3 days per week depending on the rotating schedule. The project took place in the first semester of the 2017/2018 school year, from August until December. Several follow-up activities also occurred in the second semester of the 2017/2018 school year.

Students were first introduced to the topics of math anxiety and bibliotherapy during the Intensive Reading group. While working with the Intensive Math teacher and through discussion with the general education math teacher, the ESE teacher wanted to see if the students' disengagement with math, frustration, avoidance, and low-test scores were perhaps the result of unrecognized math anxieties. The students in the Intensive Math/Reading groups avoid doing homework and when they do, they often do it incorrectly. The students also verbalized their dislike for math by making statements, "I am not good at math", "I hate math", or "What is the point of math?" Other comments included, "No one likes doing something they struggle with; that is why I do not like math."

Strategies Used During Reading and Math. Pre-reading strategies that focused on vocabulary were used for each book. Students used a website, vocabulary.com, to understand some of the words found within the texts and they created illustrations that defined the words. Sometimes, the students would read independently and sometimes the books were read together as a group. If students wished, they could also read in a small group with the teacher or continue reading independently. Students were held accountable for their reading through formative assessments using vocabulary and comprehensive questions based upon their reading.

Journaling was another strategy used throughout the semester. Discussions focused on the characters' feelings towards math; students were encouraged to journal as it related to their own personal feelings towards math. Comments from the journals included, "We could relate to the character because she struggles with math like we do..." and, "She fell asleep on her book and dreamt and, sometimes I daydream during class because I am bored from taking too many notes and then I miss the notes." Also, "This makes me get further behind."

At the conclusion of reading the books and after winter break, the students were asked to complete a second "*Mathitudes Survey*" and take a second "Math Anxiety Test." They were also assigned to write another "Math Autobiography" so that they could reflect again on their attitudes toward math. The goal of the project was to observe any changes in attitudes towards math while using bibliotherapy and self-reflection.

The final strategy also took place at the beginning of the second semester and this focused on the student's perception of their own study skills. Given a choice of writing a poem, drawing a picture, or writing an essay, students were asked to show what they had learned about their own study skills and what improvements they would make for the new semester in math. Student work reflected skills such as: using friends to study with; staying on task; using websites and other study resources; creating a study schedule; taking better notes; and, making flash cards.

Results and Discussion

According to the ESE teacher, the students enjoyed “The Math Curse” and “Math Rashes.” Students were entertained by the stories. The students did not seem to mind writing their math autobiographies as they were able to express their feelings, as well as their frustrations. They also seemed to enjoy completing the *Mathitudes Survey* and Math Anxiety Tests. By sharing their thoughts and feelings through the autobiography and surveys, the students were able to relate to the other students in the class that had some of the same negative feelings as their own and it allowed the students to see that they were not alone in their struggles with feeling inadequate in math. It also gave the students the opportunity to discuss their feelings about their perceptions of what they believed to be “bad math teachers” in elementary school in a judgmental environment.

One difficulty was the disruption to learning due to the rotation of the classes between the Intensive Reading and Intensive Math teachers. Instructional time was lost in having to remind students of previous material covered. Another challenge was the fact that students were required to receive a grade. This was especially true with the part of the project that required reading the book, “A Gebra Named Al.” The students earned grades for their Intensive Reading class based on this lesson and it was important that reading skills were incorporated into the project. The grade seemed to take away from what the teacher had hoped to gain through the project in terms of focusing on reduction of math anxiety. Because students’ grades were dependent upon reading the novel, answering questions and learning vocabulary, it seemed to add more stress in terms of the students having to complete the required reading and lessons. It would be more beneficial to use it solely as bibliotherapy without required lessons and grades attached.

Qualitative data was gathered using a *Mathitudes Survey* and Math Autobiography. Students were asked to complete both, once in August 2017 and once in February/March, 2018. The data analysis process for qualitative research involves identifying key themes or patterns that emerge from the interactions and socialization within the culture. Fraenkel et al. (2015) feel that the data analysis process actually begins “from the first moment a researcher selects a problem to study,” and ends when the “final report is written” (p. 516).

The *Mathitudes Survey* (Furner, 2007) and Autobiographies revealed three common themes: (a) students did not feel prepared for the concepts in Algebra I; (b) the length and complexity of the math problems increased at this level causing students to give up, and (c) students did not see the need for learning Algebra I. One student said:

Coming into high school, I was not prepared for Algebra...my teacher never moved me up to the regular math class I was supposed to be in. I never had good math teachers in middle school, especially my 8th grade year. The person who taught me math was a social studies teacher who had no idea what she was teaching.

Another student expressed that she has negative feelings towards math because she did not feel prepared after elementary and middle school, “My middle school teacher never taught

me any math. She expected me to learn through an iPad screen and know everything. Since then, math has always been a subject I've struggled in a lot and it made me anxious."

The complexity of math topics in high school increases so the need for a strong foundation in basic skills is essential. For example, students will begin the year with solving one-step equations but will progress to solving multi-step equations, which often include fractions and decimals. One student expressed his frustration with math as the topics became more complicated, "Long problem solving makes this even more confusing. Too many numbers can make me think things differently. Also, long problem solving can make me tired...or maybe aggravating. And when I'm aggravated, I be mad with everyone around me." Another student wrote, "Math has been difficult for me because it is a lot of work. Sometime, doing long operations can get me off track, or it can make me lose focus."

Understanding the need for math and how it relates to everyday life was another area of concern, "The reason why I think I feel this way about math is because it's always been a pain to do...and I don't see the use of algebra. You might need to know algebra for a few jobs but I don't see a situation in life where I'm going to need to know how to do this in the future." Another student wrote, "Math is just the one subject in my mind you will never need in life."

The *Mathitudes Survey* revealed that many students' favorite things in math were the simple operations of adding, subtracting, multiplying, and dividing, and that their least favorite thing in math was "dealing with letters" and that the math "gets harder every lesson." These comments reinforce the themes present in the Math Autobiographies when students felt that the math was too complex. Six out of six students who took the survey said that math stresses them out because they're not good at it. In turn, when they were asked what is one thing they would ask for, several students wrote that they want to improve their math ability, "If I could ask for one thing in math, it would be to learn fractions better." Another student said, "If I could ask for one thing in math, it would be to be better at it."

When students returned for the second semester in January, they also wrote an essay about their progress in math during first semester and what they might do to improve their math grade for second semester. The ESE teacher asked the students to develop a study plan after reflecting on how they prepared or did not prepare for math tests during the first semester. Students study plans now included skills such as note-taking, staying on task, using study websites and games, such as *Kahoots*, and studying with friends to help them be more successful.

The *Mathitudes Survey* was given a second time in February 2018. When asked again if math were a color, what color would it be, students continued to have a more negative outlook answering with dark colors, such as black, and colors that they personally did not like. Additionally, when asked if math were an animal, what animal would it be, the responses, again, represented a somewhat gloomy outlook. For example, responses included a "snake,"

“bull,” and “lion.” However, while math continues to be a challenge for these students, there was a better outlook for some. One student admitted that she has a passing grade in her math class now and is no longer stressed out by it, “math used to stress me out because I didn’t understand it.” Another student said that math is not stressful because, “it is my favorite class.”

Quantitative data was gathered using a pre and post Math Anxiety: A Self Test (Freedman, 2017). Students were given the pre-test in August 2017 and the post-test in February 2018. Students were also asked 10 questions that focused on negative feelings toward math and their math class (See Appendix A). Students rated their answers on the self-test using a Likert scale, 1-5, 1 = Disagree and 5 = Agree. The scores were totaled and the following scale was associated with the level of math anxiety, see Table 1.

Table 1: Mathematics Anxiety Score Levels

Math Anxiety Score Range	Feelings about Math Levels
45-50 points	Sure thing, you have math anxiety.
30-39 points	No doubt! The thought of doing math still makes you uneasy.
20-29 points	Perhaps!
10-19 points	Wow! Possibly a math major in the making.

The average score in August 2017 was 35.25. Low score = 27; High score = 42. The average score in February 2018 was 30.25. Low score was 24; High score was 36. Overall there was a drop of 5 points in the average scores from August 2017 to February 2018, with 7 points being the biggest difference in scores.

The decrease in negative feelings towards math during the second semester may be attributed to the students’ increased awareness of what math anxiety is through the classroom discussions and the use of bibliotherapy, connecting with characters’ similar feelings of math and anxiety. Learning ways to reduce math anxiety was also helpful for students to realize that they had control over their feelings. Things like getting plenty of rest, eating a proper diet, getting enough exercise, and having positive thoughts were all things the students could control. Often, students, and some teachers, are unaware that math anxiety is real. At the start of the second semester, the students were required to reflect and put onto paper changes they would make in study skills. This reflection helped students formulate a plan for success for the second semester. Again, another opportunity for the students to take control of their learning. This action research helped teachers to realize that there are different pedagogical approaches that can help students succeed in the math classroom.

Implications

Four recommendations and instructional changes resulted from the action research:

1. Communication with elementary and middle school teachers regarding math anxiety and their own personal math experience became a priority. The research indicated that students felt their success in math was directly related to their experience with learning math in elementary and middle school and their teacher's ability. The principal will recommend to the District Office that professional learning opportunities take place that include dialogue between grade levels, a seminar on what math anxiety is and how to help students who struggle with it, and resources for teachers who want to improve their own math knowledge and instruction.
2. Better connection made between how mathematics is used in the real world and how it is being used in more and more careers which involve technology, design, and communication. Students repeatedly said that they did not understand why they needed to learn Algebra. The school should look at partnerships with local businesses who especially use some aspect of mathematics or science that will help students make these connections. Students need to see the value in learning something that is difficult but also valuable for their future.
3. One instructional change that resulted from the action-research was the discussion about math anxiety and the real feelings produced by it. This change went beyond the Intensive Math and Reading students, impacting Algebra I and II students as well. As other teachers became aware of the action-research on math anxiety, class discussions took place. The principal recommended that each school year, the math instructors begin with the *Mathitudes Survey* and a discussion on math anxiety.
4. A second instructional change was the continued use of bibliotherapy in the Intensive Math Class. The bibliotherapy will focus on discussion and not require additional assignments for students in order to alleviate any added stress. Students need to understand that they are not alone when it comes to their feelings and anxieties about math.

Conclusion

Using Bibliotherapy and Personal Reflection as tools for reducing math anxiety can be an effective method for an Intensive Math & Reading Course where students need extra support with both reading and mathematics confidence. This paper described an action research project in a high school located in the Southeast, U.S. addressing math anxiety reduction with 9th grade students starting high school in an Intensive Math and Reading class with a Special Education (ESE) teacher using Math Anxiety Reduction protocol. The paper shared the need from the perspective of the principal of the school and how she felt students could benefit from reading about people who have math anxiety in order to build confidence. The research protocol is not new and has been advocated in previous research. The findings from this research recommend that teachers first consider students attitudes toward math as they begin the school year, and second, talk about past experiences in math

classes, even if these experiences are negative. The research is very clear when it comes to addressing math anxiety, in order to overcome or reduce it, one needs to talk about it. They need to discuss what caused it, how they feel, and how they can cope with it and develop more confidence to overcome such anxiety. Teachers can also help students when they are better prepared to teach study skills, note taking, how to approach homework and how to prepare for quizzes and tests.

Most research on math anxiety points out the distinction between reduction and prevention. The best approach for preventing math anxiety is using what is considered “best practices” for teaching mathematics. In turn, reduction is much different and requires more counseling and desensitization techniques, discussion, counseling, reflection and even bibliotherapy. Today, as students enter middle or high school, they should be evaluated and checked for their dispositions toward mathematics. Teachers need to take on the role of counselor or team up with other specialists to address any student who has negative feelings towards mathematics, which can hold them back or prevent them from having success during the next few years. The principal, ESE teacher, and professor worked as a team in developing protocol to help 9th graders address math anxiety and other fears of quantitative reasoning. According to Venables (2014), teachers can no longer work in isolation. It is essential that teams “collectively and collaboratively” work together for the success of students (pg.103). This project has helped some of the students understand their anxiety and it has given these students the tools for studying and learning math, building their confidence. It is critical that when students graduate from high school they can say: “I like math and I can choose any career I want and I will never let math hold me back from my dreams.” When math teachers allow students to discuss their feelings and self-reflect on their learning in math class, when they start to understand and can then develop a passion for math, then teachers can unlock a treasure and love of math that can help their students for their future.

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Appendix A: *Mathitudes Survey*

Name_____

Grade_____

Math Class_____

Age_____

Career or Career Interest_____

Mathitudes Survey

1. When I hear the word math I.....
2. My favorite thing in math is.....
3. My least favorite thing in math is.....
4. If I could ask for one thing in math it would be.....
5. My favorite teacher for math is_____because_____
6. If math were a color it would be.....
7. If math were an animal it would be.....
8. My favorite subject is_____because_____
9. Math stresses me out: True or False Explain if you can.
10. I am a good math problem-solver: True or False Explain if you can.

FINDING WORDS: STUDENTS TAKING PART IN THEIR VOCABULARY DEVELOPMENT

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Abstract In this article, teachers and a teacher educator share their experiences developing the responsibility for increasing vocabulary knowledge with struggling readers who are multilingual and/or have learning disabilities using a shared view of identifying students' needs in literacy development. The project included an innovative approach of self-selection of unknown words, giving the responsibility for learning back to a diverse population of students to stimulate a proactive approach to their learning. Their successes and challenges are described, and their progress is notable.

Keywords: teacher action research, vocabulary, literacy development

Introduction

Vocabulary development for a diverse population of students in schools now is becoming more important than ever for struggling students. Since comprehension is the ultimate goal for reading, if vocabulary words are not understood and used, it becomes extremely difficult for students to follow, discuss, and learn the content of text. It is estimated that vocabulary size increases by 9,000 words from first grade to third grade and by 20,000 words from third grade to fifth grade (Wang, 2014). As students get older, they become more exposed to informational, non-fiction texts with challenging vocabulary words. If the students do not understand these words, it will impact their comprehension abilities. If students have limited vocabulary knowledge and do not understand basic words, they are unlikely to figure out more challenging words. Therefore, vocabulary instruction in schools has been identified as an important element in early intervention and all classroom activities.

Literature Review

Beck, McKeown, & Kucan (2013) have investigated this need, and addressed it with suggestions for work with students. They note that the vocabulary gap for many students

with language differences and disabilities exists by the age of three due to low socio-economic (SES) status, and this gap can be detrimental to learning since it usually continues throughout the school years. It is important for teachers to consider the nature of the vocabulary words that are taught in content area instruction. Beck et al., developed a model of tiers to describe writing samples: Tier One words are common or basic words which require little or no instruction (e.g., come, see); Tier Two words are more frequent along disciplinary lines (e.g. compare, contrast); Tier Three words are characterized by discipline-specific word use (e.g., atom, continent). Analysis of these tier levels in students' discourse and reading reveal vocabulary knowledge and provide insight for teachers into students' potential for reading comprehension, and provide data for comparison with students' perceptions of their competencies so they can realistically set goals.

One consideration is that teachers need to reach out to students to gain insight into their students' challenges so they may deliver individualized instruction. Therefore, the purpose of this study was to investigate the impact of developing students' participation, and therefore, ownership, of their own school-based vocabulary knowledge on their learning achievement. In order to accomplish this goal, we integrated the new use of an innovative vocabulary intervention program that included teachers who are learning specialists in the collection of data regarding language--specifically vocabulary knowledge--of young bilingual and special education students through the use of vocabulary strategies in the classroom activities. The specialists' worked in a parallel fashion, and they compared their results of the specific strategy as they work for different populations of students. The inquiry questions that drove this study were: How well can Dual Language students self-monitor their vocabulary development in and outside of the classroom? What is the impact on learning when students self-select vocabulary words for small group study?

Theoretical Framework. Three areas of research development impacted this study aligned with the Common Core Standards Initiative (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010). These areas of research review included the role of language (i.e., discourse), aligned with CCLS Standard 1 within content area instruction; content area teachers' use of literacy strategies in classroom instruction, aligned with CCLS 4; and the impact of academic vocabulary knowledge, aligned with CCLS 6 on diverse students' school students' achievement.

A first frame of thinking study is that as the student population within schools becomes increasingly more diverse, literacy instruction requires student-focused approaches to teaching. Readings of government initiatives and assessments (e.g., U.S. Department of Education, 2002), national standards (e.g., CCLS, 2010; International Literacy Association, 2017) and educational statistics (Perie & Moran, 2005) mandate that we consider students' individual language, literacy, and learning needs that stem from cultural and linguistic diversity. More specifically, educators need to focus on the academic (i.e., word meaning) and social vocabulary (i.e., word use) that students develop, contributing to their reading comprehension and writing competencies (Falk-Ross & Evans, 2014). This is especially important for the increasing number of schools in which language difference is a factor in learning (Brown, 2007). Garcia, Jensen, and Cuellar (2006) discuss the impact of language

use on school content achievement. Hart and Risley's (1995) study is especially clear about the meaningful differences there are in vocabulary knowledge among diverse populations. A second major framework for conducting this study is that teachers are likely to use new knowledge and strategies that build on their everyday existing practices and through classroom observations (Danielson, 2012). This practice is one form of educational professional development, which is meant to support teachers at all levels "to improve the quality of classroom instruction; enable individuals to grow professionally; [and] introduce practitioners to the practical applications of research-validated strategies (NYC Department of Education, 2013). The use of professional development activities through modeling experiences are important to introduce and support new attention to literacy instruction in content area classrooms, as explained in the research of noted experts (e.g., Gillan & McFerrin, 2002; McKenna & Robinson, 1990; Sturtevant & Linek, 2007).

A third frame for our thinking as the study was developed is that content area learning is embedded in vocabulary-rich instruction, which may be an obstacle to students marginalized by cultural or linguistic difference (Ogle, 2010; Proctor, Dalton, & Grisham, 2007) or disabilities (Tam, Heward, & Heng, 2006). Instructional activities using language-based activities are effective for developing academic language for specific content area learning (Thier & Daviss, 2002). Teachers who receive professional development in classroom environments to understand the specific needs of struggling readers can be better equipped to provide effective content area instruction. It has been found that teachers who interacted with struggling readers in urban settings changed their perceptions about these students (Falk-Ross & Wolfe, 2004). Studies of teachers working with second language learners have shown that they learn to improve their instruction through reflective practice (Farrell, 2011) and classroom observations (Lewis, Maerten-Rivera, Adamson, & Lee, 2011).

Methodology

The research participants (teachers and students) were recruited this spring 2018 semester from school classrooms. Three teachers participated in the collection of data with their 20 students who were multilingual and/or had learning disabilities; one program director guided and served as outside evaluator; and one teacher educator guided the research. Class 1 was composed of 41 fifth-graders, 70% of whom were native Spanish speakers, and their language was composed of code-switching behaviors (i.e., using two languages to form word constructions). Class 2 was composed on 5 fifth-graders, all of whom qualified for special education services, and whole vocabulary scores were 1-2 grade levels below their own. Class 3 was composed of 39 fifth-graders, 66% of whom were native Spanish speakers, and all were of mixed reading levels from on-grade level to two years below grade level. Following collection of consent forms and meetings to align instruction and assessment in all classes for reliability, teachers and educators conducted the self-selection strategy in their classrooms using almost identical delivery. Teachers introduced, modeled, and then guided students through a self-monitoring protocol (the approach was presented either on the front board or on paper, depending on the teacher) to identify vocabulary words taken from grade level readings to identify those words that for them are: -tough words, -

confusing passages, -those needing pauses to recall and reflect while reading ('think aloud strategy'), and those for which they needed support. The students chose words that each felt was necessary for him or her to learn, and added them to a list, consistent with a Vocabulary Self-Collection (VSS) approach Ruddell & Shearer (2002). This approach is a fundamental way of opening students' minds to the wealth of words they encounter in print and the oral language that surrounds them each day: raising word consciousness. As described by Ruddell and Shearer (2002), the method is explained at this link (http://www.cengage.com/resource_uploads/downloads/0534508294_22092.pdf) and implemented as follows:

Step 1: Students are asked to search their viewing, reading, and home environments for a word to nominate for the weekly class vocabulary list. The nomination process involves telling:

- a) where they found the word;
- b) what they think it means; and
- c) why they think it should be on the class list. The teacher also nominates a word each week, giving the same information.

Step 2: In discussing each word, definitions are refined, and dictionaries or other sources are consulted as needed.

Step 3: When the final list of words has been selected, students record the words and definitions in their vocabulary journals.

Step 4: The words are further studied through the week, using discussion, semantic mapping, semantic feature analysis, and other interactive activities.

Step 5: At the end of each week, students are tested on their ability to spell each word, explain its meaning, and use it in a sentence.

Step 6: Every three weeks, past word lists are reviewed, and students are tested on five randomly selected words from past weekly lists.

In all classes, students brought in self-selected word to be added to a weekly list on Mondays. All students' words were identified for their source and listed on a chart or Vocabulary Log using a Vocabulary Rating Scale (Young, 2005). New vocabulary words were selected by vote, pronounced, explained, and then written in journals with dictionary-assisted descriptions. Throughout the week, words were discussed in dedicated time (See Appendix A.).

A mixed method of qualitative and quantitative approaches was used to determine outcomes of the study. For the quantitative data, formal assessment of vocabulary development occurred with the oral reading fluency scores on the school-wide oral fluency subtest of the using the AIMS- web System Oral Reading Fluency (ORF) assessment developed by Pearson Education (AIMS-web.com, 2009) which is a progress monitoring system during which educators gather data focused on reading elements one-on-one with students, and transfer this information to the online system for a quantitative analysis. Informal classroom assessments were in the form of three vocabulary mini-quizzes (i.e., for formative and then summative quantitative assessment) to be counted for progress reports. Students' absences

did not allow this to be the reliable data; however, they were then used to provide feedback and practice for students to view their efforts.

For the qualitative data, student interviews in class (i.e., qualitative assessment) were coded for recurring themes. Teachers met twice per month throughout March-May 2018 to check progress and collect data, and to conduct periodic reviews of the word knowledge as students studied on their own to build vocabulary. The trustworthiness, or transparency, of the research study was developed through careful observation of multiple forms of data to make clear the credibility (i.e., truthfulness) and consistency (i.e., dependability) of observations (Silverman, 2013).

The systematic approach to gathering data was considered through the evaluative process of open coding of data following a constant comparative method of analysis (Corbin & Strauss, 2014). This process was used to reveal the most obvious categories of responses. Lists of all students' comments during the were used to determine the themes. The data and early coding categories were shared and checked with two independent readers knowledgeable in literacy practices and qualitative research methodology. Both agreed with the schemes with minor suggestions for revision of wording, indicating approximately 95% agreement. The areas of disagreement were in the terms used to describe the axial codes, or larger 'themes' of findings and were adjusted through consensus.

Results and Discussion

There were three themes that were revealed as we considered the results of a semester's use of this new approach in which students chose words they needed to learn and gained empowerment and self-esteem, not to mention motivation, for being involved in their own learning.

The most promising change was in the nature of classroom discourse. The students' initiation of questions regarding self-selected vocabulary meaning in classes in and outside the focal class increased. As the three teachers asked students for their choices of new vocabulary words for their learning and that of the class, the nature of classroom discourse balanced out to more sharing of the questions and comments that are usually dominated by teacher talk (Cazden, 2001; Nystrand, 2006). There was teachers' transference of shared responsibility for students' learning of unknown or new vocabulary. In order for students to 'own' their new knowledge, in general, and their vocabulary specifically, teachers need to encourage student-initiated questions in all content area classrooms and to encourage risk-taking. They asked the teacher, *"Can I take this with me to math class?"* and asked their classmates, *"You don't know that word either?"* commented that *"I can use these words in my writing."* Students' awareness of their strengths and challenges through their own questions and comments may reveal important information for teachers. Students often elicit more information than would normally be shared in teacher-directed class discussions, since these students were often marginalized in the quick pace of the question-answer formats.

A second theme reflected students changed perception of learning vocabulary in content area classroom experiences. Besides being a powerful outcome, the students found the vocabulary self-selection activities motivating and challenging, opening up classroom conversations and personal interactions. Students who at first commented to the teacher and the class, *“These words are too long [complicated] to learn”* later commented, *“This is fun....learning new words like this”* and *“Vocabulary isn’t so bad anymore, it used to be boring.”* Students learned ways to break down and understand/use words; they were more confident; they helped one another learn new words. For example, one student offered to another, *“You should pick [learn] my word because you can use it in your narrative.”* In general, in their attempts at reading aloud, all students, were strongest in their decoding (or ‘calling’) of Tier 1 (basic) and Tier 2 (high frequency) level words than for Tier 3 (low frequency/subject related) taken from grade-level vocabulary. Teacher’s notes that students were confident, helping one another learn new words.

A third result was the change in students’ oral reading fluency scores on a school-wide oral fluency subtest of a standardized test. The percentage of improvement based on this new strategy ranged from about 5% to about 30%, disregarding a few outliers. (See Figures 1, 2 and 3 for charts of Changes in Students’ Oral Reading Fluency Scores). This is impressive; however, with the outliers, the results are not statistically significant. The original score does not seem to have influenced the percentage improvement. We used the mode (i.e., the most commonly occurring increase on a percentage basis) rather than the mean (i.e., the average of the sum of the scores because it reflects the most commonly occurring increase on a percentage basis).

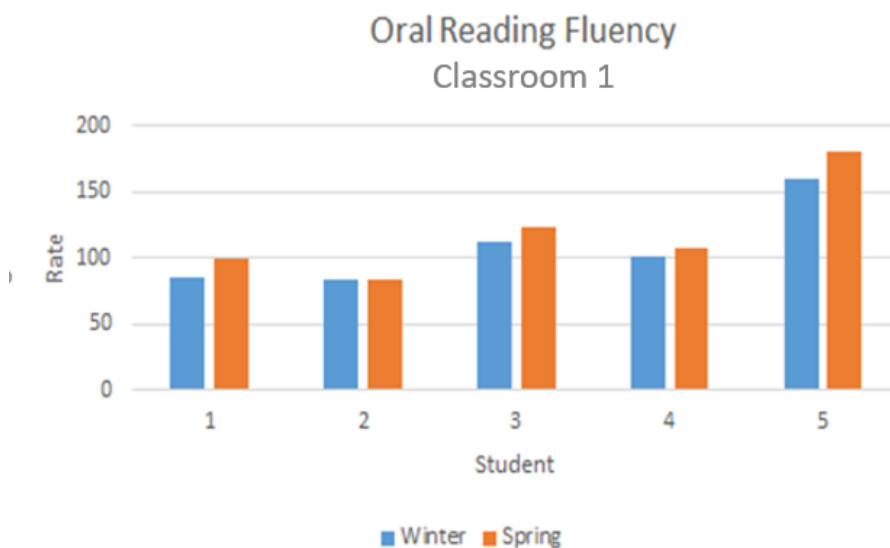


Figure 1: Class 1: Changes in Students’ Oral Reading Fluency Scores on a School-Wide Standardized Test

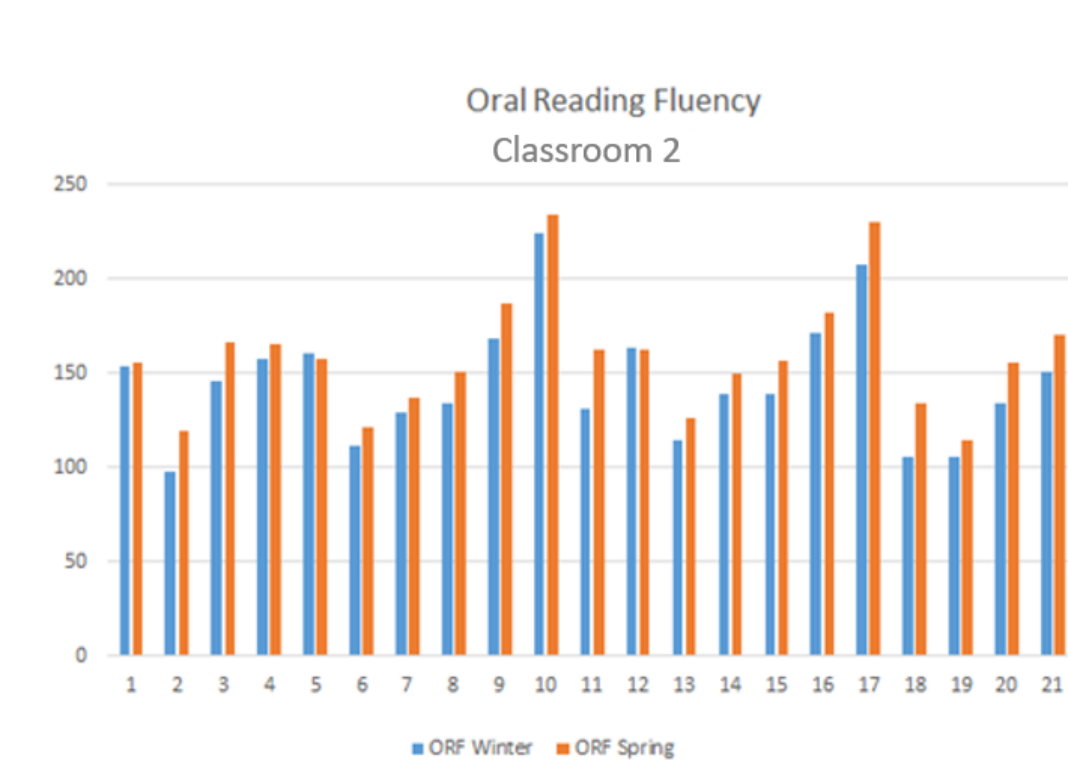


Figure 2: Class 2: Changes in Students' Oral Reading Fluency Scores on a School-Wide Standardized Test

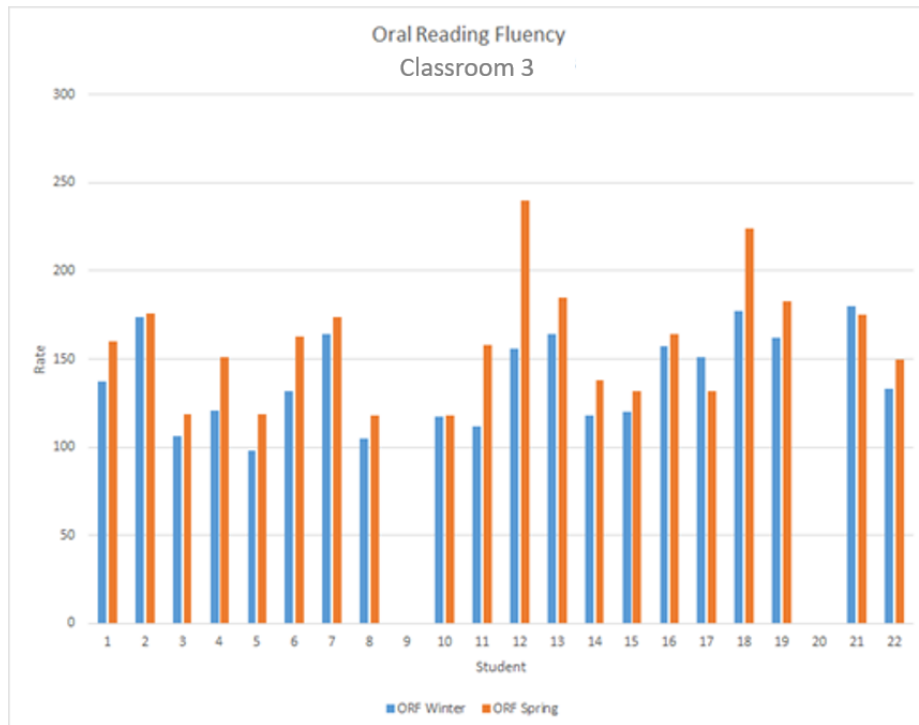


Figure 3: Class 3: Changes in Students' Oral Reading Fluency Scores on a School-Wide Standardized Test

Implications

The significance of this study is based on our opening observation, that vocabulary development for a growing diverse population of students in schools now is becoming more important for struggling students. Based on the results of this study and the teachers' continued observations, we offer the following implications and suggestions for educational applications in classrooms.

Discourse Practices in Classroom. This may include changing the classroom discourse patterns to more expanded forms. Expanded forms of instructional interaction and routines in the form of collaboration between teachers, students, & peers are key to learning and conceptual change (Almasi, 2003; Falk-Ross, 2002). All students, including those who are marginalized by language difficulties and /or by language differences (Heath, 2013), can benefit from language expansions. To more specifically understand the nature of questioning and to develop knowledge of these, a package of questioning strategies that supports students' understanding of questioning is use of Question-Answer Relationship (QAR) (Raphael & Au, 2005).

Attitudes Toward Risk-Taking. In order for students to 'own' their new knowledge, in general, and their vocabulary specifically, teachers need to encourage student-initiated questions in all content area classrooms and to encourage risk-taking. Students' awareness of their strengths and challenges through their questions may reveal important information for teachers. Students often elicit more information than would normally be shared in teacher-directed class discussions, since these students are often marginalized in the quick pace of the question-answer formats (e.g., Initiation-Response-Evaluation IRE patterns, Cazden 2001) of classroom discourse. Due to individual factors such as primary language differences or learning difficulties, students may struggle in classroom conversations; however, their communicative competence, as interpreted for individual development, is optimized if they initiate questions more easily. For example, through the use of self-initiated questions, teachers may learn about the students' self-expressed understanding of their competencies and their perceived challenges (Pitcher et al. 2007).

Use of Successful Vocabulary Strategies: A Suggestion for Classroom Application. Based on the results of this study and the teachers' continued observations, we suggest that teachers model and encourage student-initiated questions in all content area classrooms. This will involve encouraging risk-taking on the part of students, for whom initiating questions may not be the norm in classroom content-area literacy activities, and for teachers who need to allow more wait time at regular intervals for students to enter conversations with their comments and questions. We suggest that use of self-selected vocabulary learning become a system-wide protocol so students can transfer the activism for their learning in each consecutive class they attend all day, year after year.

Conclusion

In light of the diversity of students' background and each individual's academic competencies, vocabulary development is at the heart of classroom literacy instruction

across the curriculum. Teachers provide careful attention to modeling and instruction, and these are important for input, enrichment, and expansion of students' lexical repertoire; however, meaningful and authentic vocabulary development needs to be a shared activity between educators and students. Students can help us to help them learn, and this collaboration empowers each member of the team.

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Appendix A: Vocabulary Pre/Post Assessment

Name _____

Date _____

Knowing a Word is Not an All or Nothing Situation!

Vocabulary Rating Scale (Blachowicz, 1986; Young et al. 2002)

- Stage 1: Never saw/heard it before

+ Stage 2: Heard/seen it, but don't know what it means

! Stage 3: Recognize it in context as having something to do with

Stage 4: Know it well

On my own	Read by an adult	Word
		abandon
		amputate
		compassion
		devotion
		ecstatically
		eventually
		evidence
		instinct
		loyalty
		malignant
		passive
		rambunctious

ACTION RESEARCH IN AN ETHIOPIAN CLASSROOM: INSTRUCTIONAL METHODS THAT IMPROVE VOCABULARY RETENTION

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Abstract In the fall of 2017, this action research study was conducted to examine the vocabulary retention of 19 kindergarten students who are English Language Learners (ELLs) in an elementary school in Addis Ababa, Ethiopia. Prior to the study, the kindergarten teacher was asked to report student's vocabulary knowledge as a baseline measure. Next, three instructional activities were used daily with the students: (1) a worksheet, (2) a jazz chant, and (3) a picture book read-aloud. Data were collected for three days and analyzed to determine which activity yielded higher levels of English vocabulary retention. Descriptive statistics and the Friedman test were used. The results revealed statistically significant differences across days for the worksheet and the picture book read-aloud. The picture-book read aloud activity was the only method that had an increase in vocabulary retention scores. Hence, this method is a recommended instructional activity to increase vocabulary retention in students in this Ethiopian classroom.

Keywords: teacher action research, Ethiopia, kindergarten, vocabulary retention

Introduction

In Ethiopia, challenges in primary education include gender gaps (more males than females in schools in rural areas), high dropout rates, and educational quality. To address these challenges, Ethiopia's Ministry of Education, in collaboration with UNICEF, implemented

new initiatives such as the O-class School Readiness Program. At the primary level, the number of primary schools increased from 12,089 [in 2001-2002] to 33,373 in 2014-2015. During this same timeframe, student enrollment increased drastically from 54% to 94.3% (MoE, 2017).

One goal of the Ministry of Education is for educators to design a comprehensive curriculum to facilitate the holistic development of the child (MoE, 2017). Authors of the Ministry of Education 2017 Report conveyed the need to

- Contextualize the content of the curriculum by using local learning and play materials such as games, stories, songs and puzzles, and organize technology supported learning and reading corners;
- Include activities that promote national identity and unity within diversity with particular focus on mutual respect, cooperation, inclusiveness, values of patriotism, through children's literature games, stories, music and experience sharing programs and moral education (p. 14).

In Ethiopia, across school levels, educators have integrated English and Amharic into the curriculum (CIA, 2017; Federal Democratic Republic of Ethiopia, 2010). The instruction of a second language in the schools involves the implementation of an English language curriculum (USAID, 2018).

Learning a New Language. English as a Second Language (ESL) denotes the form of teaching wherein English language learners receive specialized instruction to assist with the development of English language skills (McFarland, 2017). Language One (L1) is the first language an individual knows, typically their native language (The Condition of Education, 2017). Language Two (L2) is the second language or target language of an individual (McFarland et al., 2017). Specialized instruction in ESL classrooms includes a conversational aspect, whereas a teacher asks students questions and the students answer. Other techniques involve using visual displays, encouraging conversations with peers, using academic language in the classroom, and teaching challenging content and vocabulary (Lara-Alecio, Tong, Irby, & Mathes, 2009).

Learners concentrate on, process, and retrieve information differently (Bas, 2008; Dunn & Dunn, 1992; Ghosn, 1997). Relatedly, Gardner (2011) described eight types of intelligence (e.g., verbal-linguistic, musical-rhythmic) in Multiple Intelligences Theory. While everyone possesses these intelligences, Ghamrawi (2014) asserts the development varies among people. For example, some people are stronger in the verbal-linguistic domain, while others are stronger in musical-rhythmic intelligence. It is essential to implement varied teaching techniques to ensure students are taught in a way that they learn best (Ghamrawi, 2014).

Teaching Vocabulary Words. Learning a new language involves acquiring new vocabulary (Lin & Hsu, 2013; Ramachandran & Rahim, 2004). Vocabulary is involved in the four components of language: listening, speaking, reading, and writing. According to Lin and Hsu

(2013), teaching the vocabulary of a new language contributes to language fluency. Vocabulary acquisition is the process of learning and understanding new terminology to such a degree that it can be used accurately in oral and written communication. Meanwhile, vocabulary retention is the continued understanding and use of mastered language (Snow, 2008).

In the ESL context, a limited vocabulary impedes language learning. Therefore, vocabulary is critical to the learning process (Karakoç & Köse, 2017; Lin & Hsu, 2013). Language acquisition techniques in English language classrooms have relied heavily on methods that combine social skills with language development. These techniques include songs, skits, conversation circles, and storybook readings. According to Ghosn (1997), repetition alone was ineffective at increasing vocabulary retention. However, repetition was more effective when used with several engaging activities, rather than one monotonous activity (Ghosn, 1997).

Ghamrawi (2014) used the Multiple Intelligences Theory as a framework for ESL research at a preschool in Lebanon. Students in the classroom where the teacher utilized multiple intelligences (e.g., drawing, acting, and musical performance) had higher vocabulary acquisition compared to the control group that received traditional teaching. In their experimental study about vocabulary acquisition, Lin and Hsu (2013) examined the efficacy of hierarchy vocabulary exercises to copied vocabulary exercises. The experimental group retained more vocabulary compared to the control group, which indicated that varied vocabulary exercises that required more mental processing increased language learning.

Scholars have discussed the varied ways of teaching another language and the related aspect that different learning styles affect vocabulary acquisition (e.g., Collins, 2005, 2010; Lin 2014, McFarland et al., 2017). For instance, Collins (2005) indicated that increased exposure to read-alouds increased vocabulary retention. Similarly, Lin (2014) studied semantic explanations and determined that receiving explanations for new terminology increased vocabulary knowledge in English Language Learners. Children who received these explanations in conjunction with new vocabulary retained more knowledge (Collins, 2005; Lin, 2014). The purpose of this action research study was to investigate which instructional method was the most effective at increasing students' vocabulary retention.

Literature Review

Vocabulary development requires learning new words (Shintani, 2012). In this literature review, we focused on three methods of instruction: (1) worksheets (2) jazz chants and (3) picture book read-alouds. There is a description of each instructional strategy and relevant empirical literature.

Worksheets in Instruction. When teaching English as a Second Language, standard practices include utilizing worksheet methods with challenging exercises. These practice exercises were designed to evaluate and monitor comprehension (Bas, 2008; Hansen, 2006). Capable students benefit from routine worksheet use. However, this has encouraged memorization skills rather than the acquisition of language skills (Hansen, 2006). Students who solely used

textbooks for language acquisition were less able to speak fluently in that language compared to students exposed to altered instructional techniques (Ghosn, 1997; Lin & Hsu, 2013). Worksheet instruction involved the students observing the teacher and copying proper grammar usage and vocabulary on paper. Students did not have an opportunity to showcase creativity or lead the class (Bas, 2008). English worksheets limit the vocabulary students acquired because of their teacher-centered nature (Cianca, 2012).

Curtin (2005) reported that Spanish speaking ESL students preferred to learn by writing an example simultaneously and engaging interactively with their teacher. This instruction was better than just listening and observing the teacher lecturing from the textbook. As these studies indicate, worksheets and textbook instruction are insufficient and not interactive teaching methods. Trisnarningsih (2015) determined that using worksheets to teach English to Indonesian students was an effective and efficient practice. The researcher found that students had improved pronunciation and grammar as well as increased vocabulary after utilizing the worksheets as compared to their baseline.

Within language textbooks and other learning resources, words, and images usually held a contextual relationship (Lin, 2014; Weninger & Kiss, 2013). For example, a textbook accompanied the word *friend* with an image of two boys in school. The same word was shown with a picture of two boys at a restaurant (Ghosn, 1997). For a non-English speaker, representing the word with two different images was confusing. Moreover, resources should illustrate vocabulary words with images in their most rudimentary form (Ghosn; 1997; Li, 2014; Weninger & Kiss, 2013). Scholars recommended that words and images be culturally relevant (Birrell & Tinney, 2008). Culturally-relevant materials increased learning by decreasing social and cultural barriers, resulting in more student-teacher collaboration (Birrell & Tinney, 2008; Eusafzai, 2015).

Jazz Chants in Instruction. Another communicative approach to language teaching that helps students understand semantics was a jazz chant. A jazz chant is a rhythmic expression of Standard American English displaying situational contexts (Graham, 2006). In Kung's (2013) study, varying jazz chants were conducted before instruction took place for 12 weeks in a Taiwanese English as a Foreign Language (EFL) intermediate class. First, the students performed the chant with the instructor and repeated the instructor's words. Next, the students conducted the chant without the help of the instructor, and lastly, they performed in a group. During the chants, the teacher would tap along and play music to create more rhythm. Following the jazz chants, the teacher taught vocabulary and grammar. Also, the teacher encouraged students to rehearse the chants outside of class every day (Kung, 2013).

Kung (2013) found that jazz chants enhanced the students' listening and speaking abilities and their comprehension. The students also noted that the jazz chants made learning more exciting and motivated them to learn English on their own time. Lastly, after the 12 weeks, the students remarked that they were more courageous and confident in their speaking in general and in a public setting. One student stated that chanting as a group decreased their speaking anxiety. The statistically significant results indicate that jazz chants are an effective technique for teaching English (Kung, 2013). Indah and Putri (2016) supported Kung's (2013) assertion of jazz chants being effective. Researchers found the related methods of

incorporating music by singing or listening and performing poetry useful in the language classroom (Alisaari & Heikkola, 2017).

Picture Books in Instruction. Collins (2005) examined vocabulary acquisition in 70 Portuguese preschoolers learning English. The subjects in the experimental group listened to stories three times a week for three weeks, and new vocabulary words were explained by pointing out context clues and giving synonyms and definitions. The control group had the same conditions except new vocabulary was not described to them. The experimental group had higher vocabulary scores compared to the control group. In two separate studies, Collins (2005, 2010) demonstrated that explaining new vocabulary while reading a picture book increased vocabulary acquisition in ESL learners.

Introducing new vocabulary during read-alouds is useful because the language is more diverse than textbooks, making it authentic and meaningful (Shintani, 2012). Lin (2014) demonstrated the usefulness of context clues in language acquisition. Lin's (2014) study consisted of 45 ELL fourth-grade students who were native speakers of Mandarin Chinese. The teacher read a book and pointed to a picture, defined it, and acted out the word where applicable. At the end of the five-week study, children took a multiple-choice vocabulary test. Children who received vocabulary explanations scored higher on the examination compared to those who did not. Other researchers have demonstrated that picture books increase vocabulary acquisition (Penglia & Puttasem, 2017). Also, picture books are more effective than textbooks in teaching vocabulary Hashemifardnia, Namaziandost, & Esfahani, 2018), and picture books increase vocabulary and student interest in the learning material (Kalantari & Hashemian, 2016).

Methodology

The purpose of this action research study was to investigate English vocabulary retention using three instructional methods in an Ethiopian elementary classroom. The study occurred in December 2017. The research questions were

1. For each instructional practice, was there a statistically significant difference in vocabulary retention by day for students?
 - worksheet
 - jazz chant
 - picture-book read-aloud
2. Which instructional method increased students' vocabulary retention the most?

Research Design. This action research was a systematic inquiry conducted by teachers interested in improving the teaching and learning process. Action research enables us to gather information about how schools operate, how teachers instruct, and how students learn (Mills, 2007). In classrooms, action research allows teachers to study their instructional methods, students, and assessments—"to better understand them and be able to improve their quality or effectiveness" (Mertler, 2017, p. 4). Action research involves educators working together to focus on the unique characteristics of the population in which a practice is employed and with whom action can be taken (Mertler 2017) to inform

future methods (Creswell, Hanson, Plano Clark, & Morales, 2007; McNiff & Whitehead, 2011).

Participants. In this kindergarten classroom, there were 19 students in total: six boys and 13 girls. The students' native language was Amharic. The students ranged from approximately four to six years of age. The students were being taught English during school.

Setting. This study occurred at a private school located in Addis Ababa, Ethiopia. This non-profit school provides education to students from low-income families in Ethiopia who are affected by HIV/AIDS. Students receive a uniform, tuition, stationery supplies, and food. At the school, students learn Amharic and some English (Fregenet Foundation, 2013). In 2004, the school opened with a few teachers and approximately 30 pre-school students. Since then, student enrollment increased to nearly 300 students across various grades and school sites.

In 2015, the secondary researcher visited the school and interacted with the administration, teachers, and students. During the 2015 visit, informal teaching observations occurred. The educators use worksheets to teach literacy and mathematics. A lesson was taught by the teacher, and the students were expected to recreate the strategy modeled independently on worksheets (H. Higgins, personal communication, November 2017). Direct instruction was used across these grades. Every student has a composition notebook used throughout the day. Due to changes, currently, the school consists of students in grades pre-K to 2nd grade (Fregenet Foundation, 2013).

Connection to the Research. The primary researcher was a pre-service teacher who was completing an honors thesis at the University of North Carolina Wilmington (UNCW). The primary researcher made the book that was read aloud as part of her Children's Literature course at UNCW. During the 2017 Ethiopia Field Experience, she collected data for her thesis. The secondary researcher, UNCW faculty, co-led the Ethiopia trip and supervised this research.

First Day at the School. On the first day at the school, intentionally by design, the primary and secondary researcher observed the kindergarten teacher teaching lessons on Amharic, mathematics, and English. Before implementing the instructional strategies and collecting data, one day was spent becoming familiar with the teachers, students, and instruction at the school.

Instructional Methods. The instructional methods used in the study were a worksheet, a jazz chant, and a picture book read-aloud. The worksheet had color words because colors are useful adjectives in any language. Body parts were chosen for the jazz chant because the nouns are familiar despite background. The picture book had vocabulary words that students encountered in their lives. They were selected from photos taken on the 2015 faculty-led Field Experience in Ethiopia organized through the Watson College of Education. There were five words per instructional method. In total, the strategies included 15 English vocabulary words (see Appendix A).

Worksheet. For this activity, the primary researcher passed out a half-sheet of notebook paper with the five colors (red, blue, orange, green, purple) on it to each student. She wrote the five vocabulary words on the chalkboard at the front of the classroom. Using a yardstick, she pointed to each word, said it loudly, and then led to the corresponding color on the worksheet. Students wrote the vocabulary word next to the color. Then, she began the repetition of the vocabulary. She pointed to each word on the board, said it loudly, and the students repeated the word. She did this process three times for each word each day of data collection. Data were collected by removing students individually from the classroom and administering a copy of the worksheet (Fregenet Foundation, 2013). The number of words correctly identified determined the score.

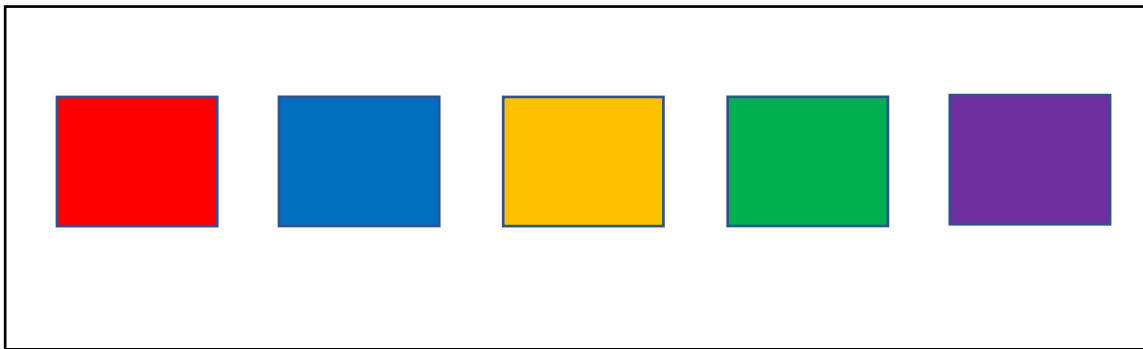


Figure 1: Drawing of worksheet for resource activity

Jazz Chant. For this method, the well-known English language song "Head, Shoulders, Knees, and Toes" was used. On each of the three days, the primary researcher modeled the song once in front of the classroom. She paused after each of the five vocabulary words (head, eyes, ears, mouth, nose) and repeated the word loudly. Then, the students sang the jazz chant three times with her. This chant included clapping and movements so that students could have fun. Data were collected by individually pulling students out of the classroom. Each of the five vocabulary words was said, and students were asked to point to the corresponding body part. Scoring was based on how many body parts the students correctly identified out of five.



Image 1: Primary researcher and students singing jazz chant.

Picture Book Read-Aloud. For this method, students listened to an English picture book that was read aloud by the teacher. The picture book used was entitled “School in Ethiopia.” The book “School in Ethiopia” was read once to the entire group of students, with emphasis put on the vocabulary words and corresponding images. The primary researcher pointed to the words within the picture book and modeled it when possible. For example, she looked to boys and girls within the classroom for each of those words. When students heard an English word, they identified the corresponding picture. Data were collected by individually pulling students from the classroom and showing each page of the book. Each page had one of the five vocabulary words. The five vocabulary words were said, and students were asked to point to the corresponding image on the page. Scoring consisted of the number of vocabulary words the students correctly identified.

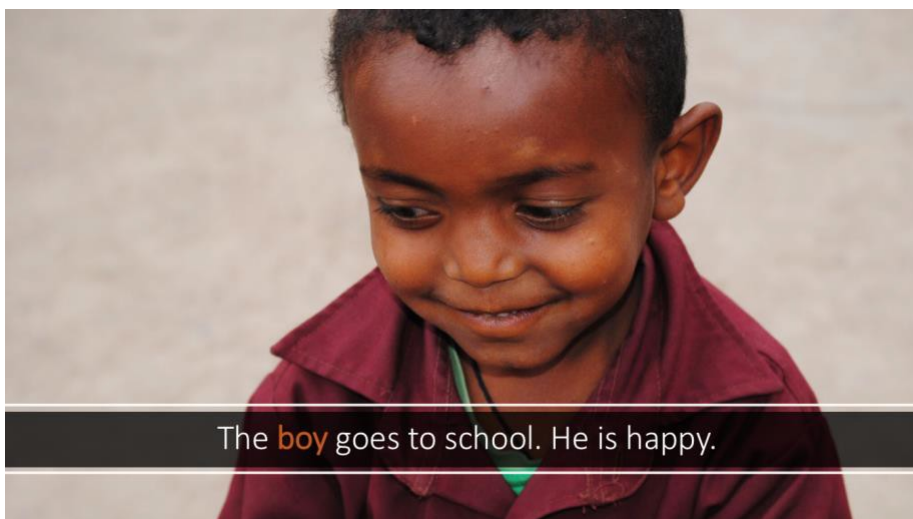


Image 2: Example page showing vocabulary word and image

Procedure. The primary researcher obtained assent, followed by the kindergarten teacher providing a global assessment of each student's vocabulary knowledge. Daily, the primary researcher implemented each instructional method and assessed the kindergarten students' vocabulary retention.

Assent Affirmation. In this study, the participants were Ethiopian students under the age of 18. A modified form of assent was used to ensure that participants were comfortable participating in the research project. First, a letter was sent to the school administrator to verify that data collection was allowed in the classroom. After that, a translator asked for the teacher's permission to conduct the study. Third, students indicated if they wanted to participate in the study with me as a visiting teacher. If they nodded, said "yes," or began active engagement in the activities, this was accepted as a modified form of assent, according to Institutional Review Board at UNCW.

Global Assessment of Student Vocabulary Knowledge. Based on the literature, one's native language vocabulary knowledge positively correlates to their ability to learn vocabulary in a target language (Droop & Verhoeven, 2003; Lindholm-Leary, 2016). Thus, at the beginning of the study, the primary researcher asked the kindergarten teacher to report the students' pre-existing vocabulary knowledge. The report was a global assessment because no language was specified. The primary researcher created a list and assigned each child a number between 1-19 to maintain confidentiality. The teacher rated the student's vocabulary from 1-3 with one being little to no vocabulary knowledge, two being some vocabulary knowledge, and three being very knowledgeable. The primary researcher recorded the results of this global assessment.

Instructional Method and Assessment. Over the next three days, the primary researcher used three teaching strategies. Each instructional method involved five specific vocabulary words. The three methods were a worksheet, a jazz chant, and a picture book read-aloud. About 20 minutes were spent on each strategy each day. The strategies occurred in the same order every day: worksheet, jazz chant, and read-aloud. The assessment results were recorded manually in a research notebook. The research notebook had individual pages dedicated to participants. Each participant's page had a table with the rows for days one, two, and three; the columns were for the three instructional strategies. Within the instructional strategy columns, the five vocabulary words for each approach were listed. Correct responses received checkmarks next to the respective vocabulary word.

The researcher determined a score for each student assessment. For example, a student who was present for the three days of data collection received nine scores in total. For an assessment, irrespective of the instructional method, the score ranged from 0-5, with 0 meaning no questions were answered correctly, and five indicating all items were answered correctly. These scores comprised the assessment data.

Data Management and Analysis. The data from the teacher's global assessment of student vocabulary knowledge, as well as the daily assessment scores, were transferred from the research notebook to Excel 2017. The assessment data, collected by the primary researcher, were organized by instructional method and day. Upon importing the data to SPSS (version

21), student absences were specified as missing data. Then, the mean and standard deviation were calculated for: (1) the global assessment of vocabulary and (2) each instructional method by day (1, 2, and 3).

The Friedman test was conducted to examine differences across days for each instructional strategy. This inferential test is the non-parametric equivalent of the repeated measures analysis of variance (Corder, & Foreman, 2009). As Corder and Foreman (2009) stated, the Friedman “test is a statistical procedure for comparing more than two samples that are related” (p. 80). Upon checking that the assumptions for the Friedman test were met, the data were analyzed. The number of students, the F statistic Chi-square in SPSS, degrees of freedom, and p-value’s relation to alpha were reported. An alpha level of 0.05 was used to determine statistical significance for each Friedman test (Corder, & Foreman, 2009).

Results

The results are presented in two parts. First, descriptive statistics for the teacher report of the global assessment of student vocabulary knowledge are provided. Then, the results for each instructional method are reported with a summary.

Global Assessment of Vocabulary Knowledge. For the teacher report of student vocabulary knowledge, each student was assigned a numeric value to describe their vocabulary knowledge. According to the report, 1 meant little to no vocabulary knowledge, 2 meant some vocabulary knowledge, and 3 meant a lot of vocabulary knowledge. In terms of prior vocabulary knowledge, the mean was 2.47 ($SD = 0.61$). One student received a 1, eight students received a 2, and ten students received a 3. Most students had some or a lot of vocabulary knowledge.

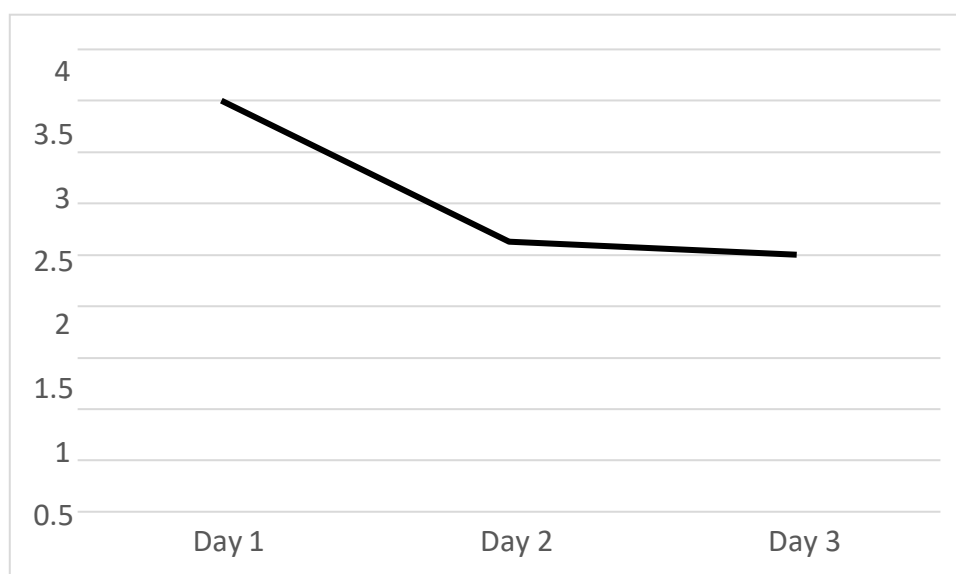
Instructional Activities. The results for each activity are provided. The findings include descriptive and inferential statistics.

Worksheet. Based on the worksheet activity, the results revealed a decline in correct responses across three days. See Table 1. The Friedman test results for the worksheet activity were statistically significant $\chi^2(1, n = 16) = 8.11, p = 0.02$.

Table 1: Vocabulary Words and Correct Responses for Worksheet

	Day 1	Day 2	Day 3	Total Correct
	n = 16	n = 16	n = 18	
Red	15	6	7	28
Blue	14	7	7	28
Orange	14	14	16	44
Green	11	7	5	23
Purple	10	8	10	28

Note: n = number of students participating in the assessment.

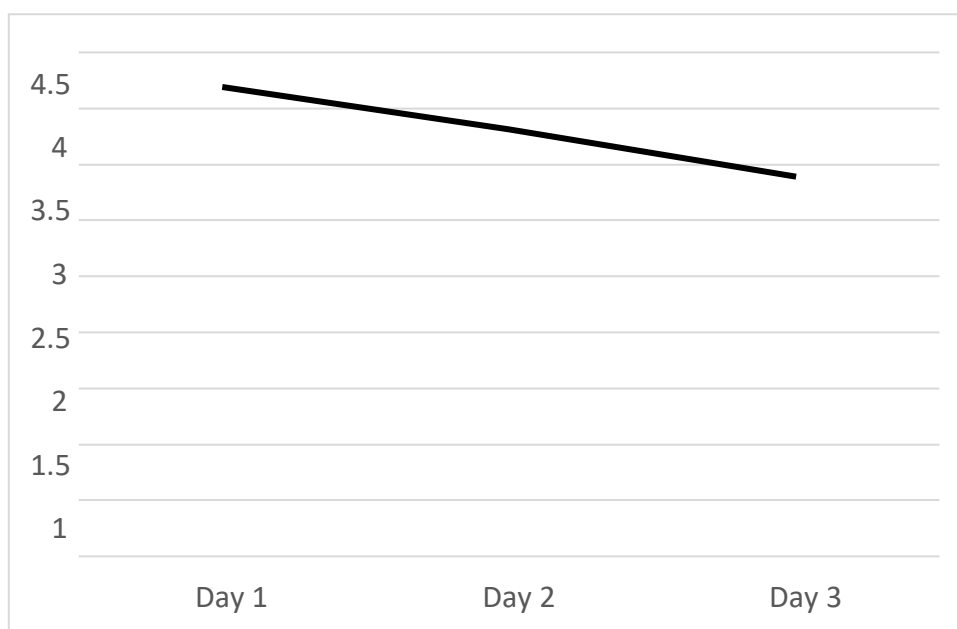
*Figure 2. Average Amount of Correct Responses for Worksheet*

Jazz Chant. Based on the jazz chant activity, the results revealed a decline in accurate responses across three days. Results for the jazz chant activity indicated a decrease in vocabulary score from day one to day three. See Table 2. For the jazz chant activity, the Friedman test results were not statistically significant $\chi^2(1, n=16) = 2.45, p = 0.20$.

Table 2: Vocabulary Words and Correct Responses for Jazz Chant

	Day 1	Day 2	Day 3	Total Correct
	n = 16	n = 16	n = 18	
Head	16	15	11	42
Eyes	15	13	15	43
Ears	11	9	11	31
Mouth	12	12	13	37
Nose	13	12	11	36

Note: n = number of students participating in the assessment.

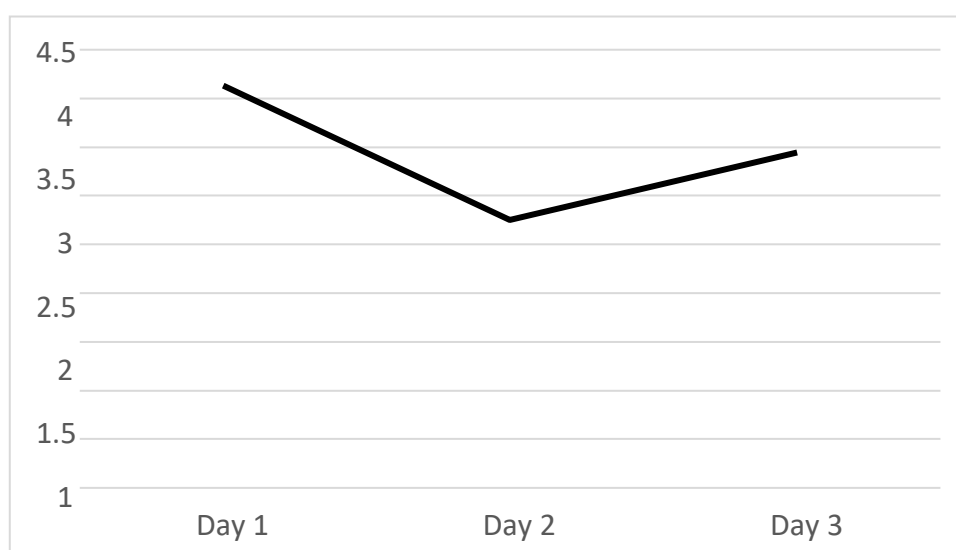
*Figure 3. Average Amount of Correct Responses for Jazz Chant*

Picture Book Read-Aloud. Based on the picture book read-aloud activity, the results revealed the correct responses declined from day one to day two, and then an increase on day three. Results for the picture book read-aloud indicated a decline in vocabulary score from day one to day two, and then an increase on day three (Table 3). The results from the Friedman test for the picture book activity were statistically significant $\chi^2 (1, n = 16) = 9.27$, $p = 0.01$.

Table 3: Vocabulary Words and Correct Responses for Picture Book Read-Aloud

	Day 1	Day 2	Day 3	Total Correct
	n = 16	n = 16	n = 18	
Book	6	7	9	22
Boy	13	5	7	25
Girl	16	6	13	35
Basketball	15	14	18	47
Smile	16	12	15	43

Note: n = number of students participating in the assessment.

*Figure 6. Average Amount of Correct Responses for Picture Book Read-Aloud*

According to the results on the third day, the average score for the picture book read-aloud method was 3.44, which was 0.05 points higher than the jazz chant method and 0.96 points higher than the worksheet method. Table 4 provides a summary of the average amount of correct responses for each instructional activity.

Table 4: Descriptive Statistics for Instructional Activities by Day and Friedman Test Results

Instructional Activity	Day One		Day Two		Day Three		χ^2	<i>p</i>
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>		
Worksheet	16	4.00 (1.59)	16	2.63 (1.96)	18	2.50 (1.65)	8.11	0.02*
Jazz Chant	16	4.19 (1.11)	16	3.81 (1.17)	18	3.39 (1.79)	2.45	0.29
Picture Book Read- Aloud	16	4.13 (0.81)	16	2.75 (1.18)	18	3.44 (1.20)	9.27	0.01*

*Note: n = number of students participating in assessment; M = mean of scores for assessment; SD = standard deviation of scores for assessment; χ^2 = Chi-square test results; p = Asymptotic significance; * indicates statistical significance.*

Discussion

In this study, the picture book read-aloud was the only instructional strategy out of the three that included concepts exclusively relevant to the students. The picture book was the only method that yielded an increase in student vocabulary retention scores. The images within the picture book were of previous students who attended the school. These results provided evidence that cultural relevance in books builds text-to-self connections and increased comprehension (Collins, 2005; Lin, 2014).

When subjects were read this book, they were able to see images of students like them. These connections may have accounted for the increased assessment scores. This finding corresponds with the Ministry of Education 2017 Report about contextualizing the content of the curriculum by the use of stories and including activities that promote national identity. Also, to strengthen the existing curriculum for pre-primary education, the same authors of the report recommended using music coinciding with research by Kung (2013).

In the picture book read-aloud instructional strategy, words were chosen based on images taken during a previous trip to Ethiopia. The vocabulary word set seemed related to the primary researcher because the words came from pictures from Ethiopia. In retrospect, the words were not wholly related. *Boy* and *girl* have no denotational relation to *book*, *basketball*, or *smile*. The word *book* received half or below half the amount of correct responses as the word *basketball* on all three days of teaching and assessment. This result was interesting since the image of a book was in the picture book, and the primary researcher pointed and modeled the word for students. After visiting Ethiopia, she realized that books are not regularly used or available within the classrooms. Because students did

not have a connection within the word set, the children struggled to learn the vocabulary. Contrastingly, students have played basketball on the school playground, so they retained this word easily. Word sets led to vocabulary understanding when the words were explicitly related (Alharbi, 2015).

Vocabulary words that seemed related to native speakers yielded different understanding rates in ELLs (Alharbi, 2015; Holt, 1995). Notably, student's vocabulary retention in this study varied across the strategies based on the words. Initially, the researcher believed that all of the color words would yield a similar level of vocabulary acquisition for the students. Yet within the worksheet method, the word *orange* had a 40% higher amount of correct answers than the word *blue* on day one. On day two, *orange* had a 50% higher amount than *blue*; *orange* was over 50% higher than *blue* on the third day. One theory about this gap is that *orange* is also a word for fruit that students may have been familiar with or recognized.

Increasing students' English vocabulary retention. Some researchers (Bas, 2008; Weninger & Kiss 2013) have suggested using worksheets as the main form of English language instruction in primary schools. Meanwhile, Kung (2013) found that jazz chants were an immense aid in English language acquisition. At first, the worksheet method was the most effective method of increasing vocabulary. However, the overall average amount of correct responses for the worksheet method declined over the three days at the school. A plausible explanation for the initial increase was that worksheets were utilized as the primary teaching method employed at this school. Over several days, it did not maximize vocabulary retention. This result supports Cianca's (2012) findings that worksheets are not an effective method of English instruction. Like other scholars (Shintani, 2012; Lin, 2014), the picture book read-aloud was recommended as the best instructional strategy to increase vocabulary for elementary ESL students. Explanations of word meanings in conjunction with new vocabulary have led children retaining more knowledge after lessons (Collins, 2005; Lin, 2014; Lin & Hsu, 2013).

Limitations

Communication and cultural barriers initially existed between the primary researcher and the kindergarten teacher. On the first day of data collection, the teacher wanted to correct student mistakes during the assessment. The primary researcher communicated that these mistakes were beneficial to the research. Another limitation was the amount of time spent at school (i.e., three days) and the small sample size.

Implications

Researchers can address cultural differences by involving the teacher in a walkthrough of the vocabulary instruction and sample assessment. The teacher can have input on the method (e.g., which jazz chant to use) and the vocabulary taught to their students. The teacher can remove words that students already know (e.g., *orange*). Teachers should select appropriate vocabulary words according to the level of the student's language proficiency (Attinasi & Minnoves-Myers, 1981; Lindholm-Leary, 2016). Another suggestion is to replace the teacher report of student vocabulary knowledge with a student pre-test with the actual vocabulary words. A pre-test would minimize potential researcher and teacher bias. We

suggest gathering more comprehensible data by conducting a prolonged study with more participants.

Conclusion

This action research study revealed statistically significant differences across days for the worksheet and the picture book read-aloud activities. The picture book read-aloud was the sole method that increased vocabulary retention scores. The picture-book read aloud method is recommended to improve vocabulary retention of kindergarten students in this Ethiopian classroom.

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Appendix A: Instructional Activities and Vocabulary Used

Worksheet	Jazz Chant	Picture Book Read-Aloud
Red	Head	Book
Blue	Eyes	Boy
Orange	Ears	Girl
Green	Mouth	Basketball
Purple	Nose	Smile

SUPPORTING ENGLISH LANGUAGE LEARNERS THROUGH INCLUSION AND TASK-BASED INSTRUCTION

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Abstract This action research study describes the influence of task-based instruction on English Language Learner (ELL) motivation in a seventh-grade inclusion classroom. This research study was grounded in a theoretical framework that involved inclusion education, ELLs, task-based instruction (Willis, 1996), and the ARCS Model of Motivation (Keller, 2008). This action research study employed a convergent parallel mixed-methods design to explore the following research question: What is the influence of task-based instruction on ELL student motivation in a grade seven English Language Arts (ELA) inclusion classroom? The participants in this study included 5 ELL students and 10 Native English Speakers (NES). The data collection methods used in this study were focus groups, field observations, student work documents, and student exit ticket surveys. Data analysis and discussion were grounded in the four dimensions of motivation, as defined by Keller's ARCS model: attention, relevance, confidence, and satisfaction. The results of this study indicated that, when responding to the influence of task-based instruction, ELL students showed the highest positive responses about attention and relevance, moderately positive responses about satisfaction, and the least positive responses about confidence.

Keywords: teacher action research, English language learners, task-based instruction, ARCS Model of Motivation, inclusion education

Introduction

Located on the Gulf Coast of the United States, Bayview Middle School (BMS; pseudonym) serves nearly 600 seventh and eighth-grade students. Almost 80% of BMS students qualify for free and reduced lunch, and BMS has one of the largest populations of English language learners (ELLs) in the surrounding area. At BMS, my goal (first author) was to provide support for both the English language arts (ELA) teacher, Brittany (pseudonym), and the students, particularly the ELLs. In this classroom, one-third of the students are ELLs. As the

ELL population in her classroom grew, Brittany wanted to find ways to meet the diverse needs of her students, specifically her ELLs but was unsure how to do this effectively. With a shared sense of purpose, we embarked on an action research journey that examined the effectiveness of teaching strategies that could better support engagement and motivation for all students, including ELLs.

Over the past 15 years, the number of ELLs in middle school classrooms in the United States has risen dramatically (U.S. Department of Education, 2018). Many middle school teachers have been ill-equipped to effectively support students who need to learn both content and literacy skills simultaneously (Willis, 1996; 2007). These rapid changes in student demographics have led to new challenges for teachers who want to “effectively and efficiently” meet students’ individual needs (Mahat, 2008, p. 82). Given the complex nature of this problem of practice, the action research approach (Mertler, 2014) allowed us to identify, integrate, and study the impact of a set of research-based supports for both the teacher and students.

Action research provides a systematic and cyclical approach to solving complex problems of practice (Mertler, 2014). In this study, I played the role of both researcher and practitioner and utilized Mertler’s (2014) four-stage framework for action research. The *planning stage* focused on understanding the problem in context, a review of the relevant literature, and the development of an intervention. The *acting stage* focused on studying the enactment of the intervention, which involved multiple, smaller cycles of action research. As a result of what we learned, we generated an implementation plan. The publication of this manuscript represents the *reflecting stage* of this instance of action research. These four stages of action research guided the implementation of this study and now serve as an organizing framework for this article.

Planning Stage: The Problem in Context. I co-taught with Brittany, who was a full-time English teacher at BMS. Additional participants of this study included the 15 students in one grade-seven ELA inclusion classroom. When attempting new strategies such as the ones developed in this study, it is wise to include a small number of participants in order to lessen the impact of any possible adverse outcomes. Action research is a well-established methodology for studying problems of practice on relatively small scales, often with fewer than 20 participants (Mertler, 2014). Of the 15 students included in this study, five students were receiving ELL services. The remaining ten students were Native English Speakers (NESs). This research study took place in the fall of 2017, over five weeks.

In our earliest conversations, Brittany discussed the challenges of maintaining engagement and motivation among her ELLs. When the NESs were being challenged and motivated, the ELL students were struggling to stay focused and keep up with the lesson. When asked about this, the ELLs expressed their desire to read, write, and participate well, but they often struggled because they were distracted, embarrassed, or confused. Brittany knew that she needed to make some significant changes to her instructional strategies in order to meet the needs of these students better.

Literature Review

A review of the literature focused on 1) the nature of inclusion classrooms, 2) strategies that foster student achievement among ELLs, and 3) strategies that foster engagement and motivation for all students. For this study, we defined inclusion as "the fundamental right of all children and adults to participate fully, and contribute in all aspects of life and culture, without restriction or threat of marginalization" (Braunsteiner & Mariano-Lapidus, 2014, p. 32). In an inclusion classroom, students with disabilities and students who are ELLs are educated with their same-aged peers in a typical classroom environment in order to meet students' unique needs within the least restrictive environment (Jacobs & Fu, 2014). Successful inclusion often involves creative methods of instruction (McCray & McHatton, 2011; Willis, 1996; 2007). A crucial element of effective ELL instruction (Willis, 1996, 2007) includes the identification and evaluation of common and effective inclusive practices (Kilanowski-Press, Foote, & Rinaldo, 2010) and the cultivation of effective communication skills (Dockrell, Bakopoulou, Law, Spencer & Lindsay, 2015; Jacobs & Fu, 2014).

After a thorough review of several instructional models, the first model selected was the ARCS model of motivation (Keller, 2008). The acronym, ARCS, comes from the four dimensions of motivation: Attention, Relevance, Confidence, and Satisfaction. In order to have motivated students, a teacher must grasp student *attention*, the students must find the instruction *relevant*, students must be *confident* and believe that they will succeed, and students must be personally *satisfied* by the learning experience (Keller, 2008). The use of the ARCS model has demonstrated a positive impact on student motivation and achievement for a wide variety of students, including ELLs (Hess, 2015; Liao & Wang, 2008). The ARCS model uncovers opportunities for teachers to develop lessons that target motivation in creative and engaging ways while also providing a framework of the particular aspects of motivation that can be measured.

While the ARCS model seemed likely to support our work as teachers, we also needed a framework to support the development of effective communication skills for ELLs. For this purpose, I selected Task-Based Instruction (TBI) (Willis, 1996; Willis & Willis, 2007). The TBI framework structures lessons around the three stages of pre-task, task-cycle, and language focus. During the pre-task stage, the teacher explores the topic with the students, makes a note of the useful phrases or words, and helps students understand the task's instructions. In the task-cycle, students work in pairs or groups to do the task, prepare to give an oral or written report, and present and compare their reports. In the language focus, students examine and discuss specifics about the text, and the teacher guides students to practice new phrases, words, or patterns that are occurring. The TBI framework provides ELLs with opportunities for authentic language use within the four language-learning domains of listening, speaking, reading, and writing. This communicative approach prompts students to communicate because an information gap exists, making it necessary to communicate in order to complete the task (Arslanyilmaz, 2012; Huang, 2010; Roessingh, 2014; Widdowson, 1978). Working in cooperative groups, conversations with group members provide the repetition necessary for language learning to progress from short-term to long-term acquisition (Zainuddin, Morales-Jones, Yahya & Ariza, 2011).

The TBI framework identifies seven types of tasks that naturally involve most, if not all, of the four domains of listening, speaking, reading, and writing (Willis, 1996; Willis & Willis, 2007). These seven types of tasks are listing, ordering and sorting, comparing, problem-

solving, sharing personal experiences, creative tasks, and matching (Willis, 1996). For a complete description of each type of task, see Willis (1996).

Development of the ARCS – TBI Intervention. Brittany worked with a grade-level planning team at the beginning of each week to collaboratively design her daily lessons. These lesson plans possessed clear objectives, aligned with local and national standards. However, they did not include documentation of instructional supports for ELLs. A preexisting school system for collaborative planning led to the development of the daily lesson plans. Therefore, I felt it would be essential to establish a planning process that could be fluid and adaptable to integrate the TBI and the ARCS models into the developed lessons.

In order to integrate task-based instruction and the critical elements of motivation into the preexisting lesson plans, I created a protocol to identify strategies for implementing TBI and supporting student motivation. Brittany and I referred to the protocol as the Task-Based Instruction Integration Protocol (TBI-IP). The protocol was designed to be used before the start of teaching a lesson and reflected seven types of tasks from the TBI framework. The protocol had five steps which included; 1) a review of the learning objectives and general structure of the lesson, 2) a discussion about the objectives of the lesson among the collaborating teachers, 3) the selection of one of the seven types of tasks from the TBI framework, 4) the integration of the task into the lesson plan, and 5) and a reflection on and documentation of the changes to the lesson. The cyclical use of this protocol for daily lesson plans was an effective strategy also congruent with the action research design of this study. Throughout the five weeks of this study, these shorter cycles of action research provided rich data in near real-time that guided our daily implementation of TBI.

Methodology

Acting Stage: The Task-Based Instruction Intervention. Throughout this study, Brittany and I used the TBI-IP to examine the preexisting daily lesson plans and identify appropriate ways to integrate one TBI activity into each lesson. Opportunities to integrate TBI differed from lesson to lesson, and the length of time designated to the task-based activity also varied. For example, in one lesson, students needed to learn new vocabulary. The original lesson plan had students working by themselves to complete a vocabulary worksheet. In order to add a TBI introduction activity to this lesson, we gave students flash cards with ten new vocabulary words and ten pictures. Students worked in pairs and completed a matching task. They placed the word next to what they thought was the corresponding picture. Students then picked three of the vocabulary words and wrote a sentence using the word in the appropriate context.

In another example, a daily lesson plan asked students to write a Schaffer Paragraph. A Schaffer Paragraph is a structured approach to paragraph writing that includes five sentences: a topic sentence, a concrete detail, a commentary, a second concrete detail, a second commentary, and a concluding sentence (Schaffer, 1995). In this particular lesson, the writing focused on describing a character from the book they were reading. As a TBI introduction to this lesson, we had students complete both a matching task and an ordering-sorting task. They received an envelope with five sentences on separate pieces of paper and five Schaffer Paragraph labels. The students worked in pairs to order and sort the

sentences so that they were in the correct order, creating a paragraph. They also labeled the sentences according to the parts of a Schaffer Paragraph.

The TBI activities for the new vocabulary and Schaffer Paragraph lessons are two examples of the sixteen different instances of TBI interventions that took place within this research study. In order to assess the impact of the interventions on student achievement and motivation, I employed four data collection strategies: student focus groups (motivation), daily field observations (attention), collection and review of student artifacts (achievement), and daily student exit ticket surveys (motivation).

Focus groups (Butin, 2010; Mertler, 2014) were used to gather information about ELL student motivation at the beginning and end of the study. Qualitative data gathered in the initial focus group informed decisions made in the TBI interventions. Each question in the focus group related to one or more of the elements of the ARCS model. For example, the question 'What makes it easy or difficult to pay attention to English class?' provided data regarding student attention during the intervention but also provided opportunities to uncover insight into the other elements of the ARCS model. The focus groups were audio-recorded, transcribed, and analyzed using a coding structure based on Keller's (2008) four elements of the ARCS model.

When students were engaged in a task-based instruction activity, I used a field observation checklist (Butin, 2010; Mertler, 2014) to identify the on-task/off-task behaviors of the ELLs in the classroom. This provided additional data that was also compared to the students' self-reported behavior on the exit tickets. During a task, I observed each ELL one time per minute and tallied if their behavior was on task or off task. These notes provided the raw data to assign each student an ordinal rating for their attention based on the five-point Likert scale (5) exceptionally attentive, (4) attentive, (3) moderately attentive, (2) less than attentive, and (1) needs improvement. Descriptive statistics were used to analyze this data, using the median as the measure of central tendency, and the interquartile range as the measure of variability, as suggested by Holcomb (2017) for ordinal data.

Student artifacts of learning (Butin, 2010; Mertler, 2014) from each of the task-based instruction activities were collected and analyzed to determine the level of student achievement occurring during each intervention. These artifacts were either the actual written student work or a photograph of a student's finished product after a task. For example, in the Schaffer Paragraph sorting activity, we have previously described, I took a photo of each pair of students' work, documenting the order in which they arranged the sentences to create a paragraph, and also showing how they labeled each sentence. I employed a process of document analysis that was standardized and specific (Butin, 2010), which focused on a student's ability to communicate rather than focusing on their grammatical correctness. Student work was again rated on a five-point Likert scale. In this Likert scale, the phrase 'well done' refers to effective communication: (5) exceptionally well done, (4) well done, (3) complete, (2) less than complete, and (1) needs improvement. This

produced ordinal data, and I again used descriptive statistics to analyze this data, using the median as the measure of central tendency, and the interquartile range as the measure of variability (Holcomb, 2017). These statistics were calculated for all students in the classroom, and the analysis of ELL student work was compared to the analysis of NES student work.

At the end of each lesson in the intervention, students responded to exit ticket surveys (Butin, 2010; Mertler, 2014) consisting of closed and open-ended questions. These questions solicited student perceptions of the lesson as they related to relevance, confidence, and satisfaction. Students responded to statements using a five-point Likert scale: (5) strongly agree, (4) agree, (3) no opinion, (2) disagree, (1) strongly disagree. Each Likert response was followed by an open-ended question that asked, 'Why did you give those scores?' Again, the ordinal data were analyzed using descriptive statistics wherein the median was used as the measure of central tendency, and the interquartile range was used as the measure of variability (Holcomb, 2017). These statistics were calculated for all students in the classroom, and the analysis of ELL student responses was compared with the analysis of NES student responses.

The qualitative student open-response questions were coded using a priori codes based on the ARCS model (Keller, 2008). Table 1 provides the definition and a student example for each a priori code. To ensure the reliability of my a priori codes, I worked with Dr. Christopher Bogiages, the second author of this article, to establish strong qualitative reliability (Creswell, 2014) with an intercoder agreement of 81.81%. I also used a second reliability measure, Cohen's Kappa, to measure agreement that takes into account the role of chance (Gewt, 2014). The results of my Cohen's Kappa statistical analysis indicated a Kappa of .749, which shows substantial agreement.

After analyzing the qualitative data from the Exit Ticket Survey from all students in the classroom, we compared the results from ELL and NES student responses. Using descriptive statistics, I calculated the frequency of student responses within each a priori code, reporting the number and percent (Holcomb, 2017). I compared the ELL and NES results. For the a priori codes, Attention, Relevance, Confidence, and Satisfaction, I additionally coded students' responses as either positive or negative, using the emergent codes Positive ARCS Response and Negative ARCS Response; Table 1 provides the definition and a student example for each of these codes.

In this way, the ARCS model and the TBI model were reflected in both the design of the data collection tools and the analysis of the data each tool generated. These four strategies – focus groups, field observations, student artifacts, and exit ticket surveys – covered the critical elements of the study from multiple perspectives. This array of data ensured high-quality data collection and made it possible to capture the outcome of this intervention in a quantifiable and objective way.

Table 1: Codebook

Code	Definition	Student Examples
Attention	Reference to 'task completion': student comments about how easy/difficult it was for them to pay attention in class, may mention participating well/not participating well, perseverance to complete the task/giving up on the task, or helping each other/not helping each other	I gave those scores because my partner and I cooperated.
Confidence	Reference to 'I can do it' in a non-emotional way: student comments about how class made them feel more/less confident, may mention how the task helped them to believe/did not help them to believe they could do well in English, might talk about the task as being easy/hard	Some of the words were harder than it was last week. But I understood it.
Negative Response	Student makes a negative or indifferent comment about attention, relevance, confidence, or satisfaction	I was very distracted by someone in the classroom, so I could NOT do my work!
Positive Response	Student makes a positive comment about attention, relevance, confidence, or satisfaction	Because I really like the group work we did today.
Relevance	Reference to 'helping': student comments about how the class helped them/did not help them to reach their personal goals, may mention why the task was important/not important to them; the student may say 'no opinion.' Reference to emotions: student comments about how satisfied/not satisfied they were with their performance in class, may mention that they are happy/unhappy or proud/embarrassed by their work in class	This will help me in my test tomorrow and use higher vocabulary.
Satisfaction		I gave those scores because I really liked when we got to explain how we got the answer.

Results

The data collection plan targeted each of the four components of the ARCS model of motivation. For the sake of brevity in this article, this data was compiled to present an overall description of student motivation during the intervention period. The data is displayed in scatterplots, showing the relationship between two variables (Holcomb, 2017). A line of best fit (or trendline) indicates the relationship between these two variables, showing change over time (Chaudhary & Kumar, 2010). Although correlation does not imply causality, the trendline suggests a relationship between variables (Chaudhary & Kumar, 2010). This trendline identifies how student motivation changed over the course of the intervention.

Positive Effect on ELL Attention and Relevance. Figure 1 shows four series of points and four trendlines, displaying the median ARCS ratings for ELLs. The lines of best fit for attention and relevance both show positive slopes, suggesting that the intervention increased ELL students' attention and relevance. For confidence, the line of best fit shows an undefined slope, suggesting that the intervention had no effect on ELL students' confidence. For satisfaction, the line of best fit shows a negative slope, suggesting that the intervention may have had a negative effect on ELL students' satisfaction.

Positive Effect on NES Relevance, Confidence, and Satisfaction. Figure 2 shows three series of points and three trendlines, displaying the median ARCS ratings for NESs. Because of the practical constraints, observation data measuring student attention was only gathered for the ELL students participating in this study. That is why data on NES students' attention is not included in Figure 2. The lines of best fit for relevance, confidence, and satisfaction all show positive slopes, suggesting that this intervention may have had a positive effect on NES students' relevance, confidence, and satisfaction.

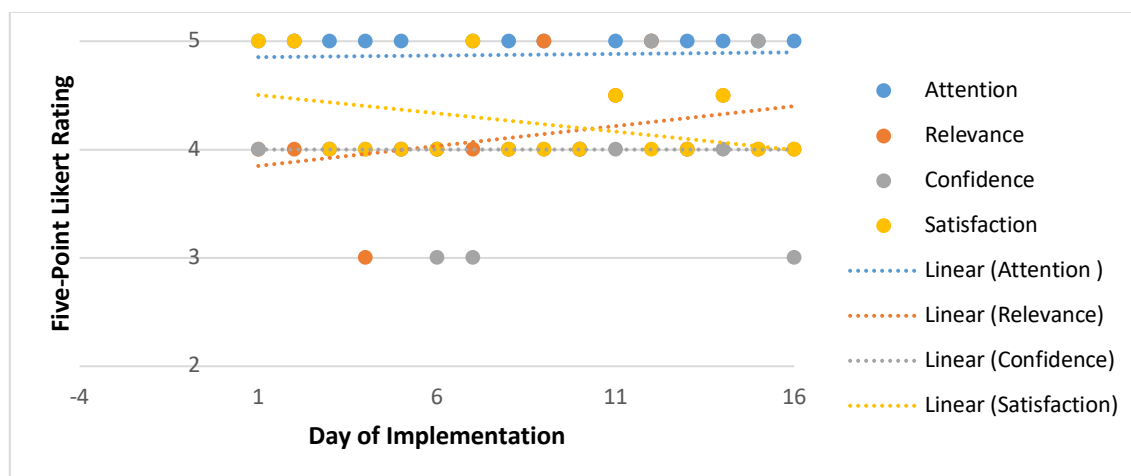


Figure 1: Median ARCS ratings for ELLs

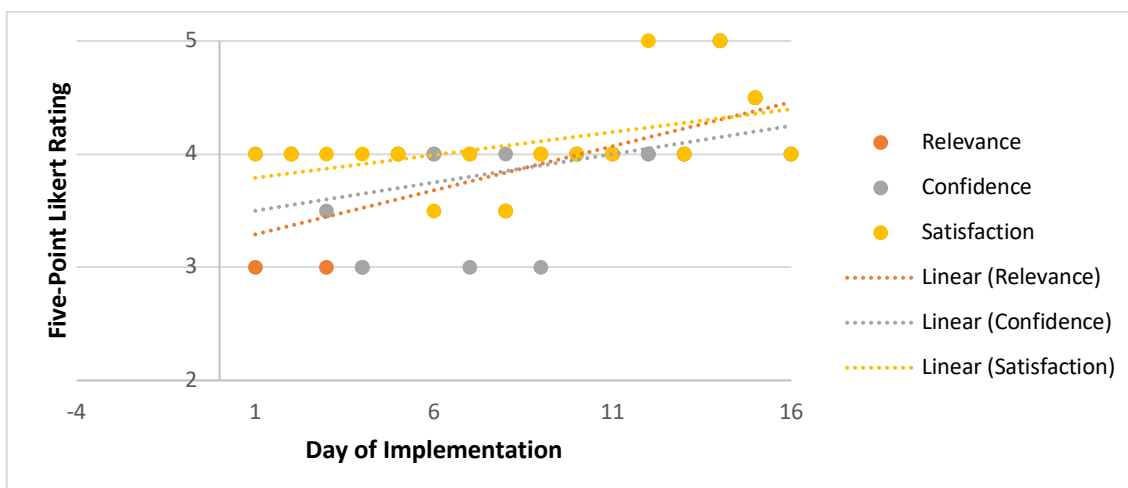


Figure 2: Median ARCS ratings for NES

Differing Effects on ELL and NES Student Work. Figure 3 shows a series of points and trendlines for ELL and NES student work. The line of best fit shows an undefined slope for ELLs, suggesting no relationship between variables; this indicates that from the beginning until the end of the research study, ELL student work stayed the same. For NESs, however, the line of best fit shows a positive rate of change; this indicates an increase in the quality of NES student work throughout the course of this research study.

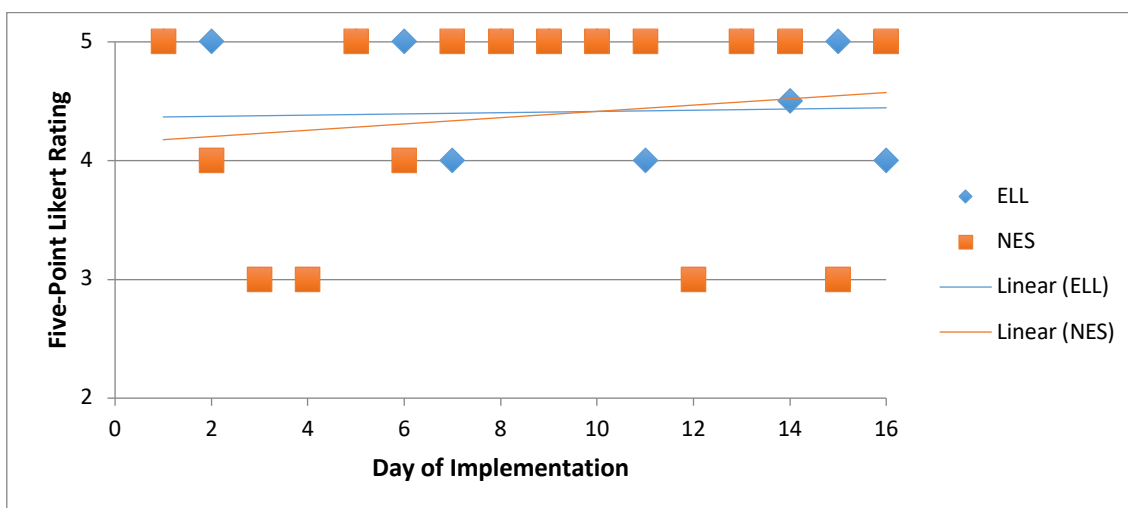


Figure 3: Student work for ELLs and NESs

Frequency of ARCS Responses. Table 2 shows the frequency and percent of student responses for the a priori codes: Attention, Relevance, Confidence, and Satisfaction. The data is broken down by student groups: ELL and NES students. Table 3 displays the percentage of times students spoke positively and negatively about their attention, relevance, confidence, and satisfaction in exit tickets.

Table 2: A Priori Code Data for ELL and NES Students

A Priori Code	ELL		NES	
	Frequency	Percent	Frequency	Percent
Attention	19	22.35	43	23.63
Relevance	28	32.94	39	21.43
Confidence	8	9.41	37	20.56
Satisfaction	30	35.29	63	34.62
Total	85	100	182	100

Table 3: Students' Positive and Negative Responses

A Priori Code	ELL		NES	
	Positive	Negative	Positive	Negative
Attention	89.47%	10.53%	72.09%	27.91%
Relevance	89.29%	10.71%	66.67%	33.33%
Confidence	75.00%	25.00%	67.57%	32.43%
Satisfaction	70.00%	30.00%	69.84%	30.16%

Discussion

Interpretation Through Focus Groups. The data displayed in the previous figures and tables can be more clearly interpreted through the lens of ELL students' voices, expressed in the focus groups. A closer look at ELL students' conversations within the two focus groups of this study helps to further interpret this data.

ELL Attention. In both focus groups, students were asked the question: 'What makes it easy or difficult to pay attention to English class?' In Focus Group One, one student expressed that he finds himself, "thinkin' about other stuff." No other students responded to the question. In Focus Group Two, however, several students interrupted me with responses even before I could finish asking the question. Two students agreed that groups are distracting when people talk to each other, making it difficult for other students to hear the teacher. One of these students also expressed, as he did in Focus Group One, that he gets distracted because he is thinking about other stuff. Three students expressed that they often get distracted because they are tired at the end of the day. I then prompted students to tell me about what makes it easy for them to pay attention. Carisa responded that working in pairs made it easy to pay attention, while Manuel expressed that fun activities,

like tasks that involved stories and pictures, made it easy to pay attention. These two students made specific references to task-based instruction in their responses.

ELL Relevance. Students were also asked the question: 'How does English class help you to reach your personal goals?' This prompted students to share if they felt the class was relevant. In Focus Group One, students' responses were minimal, but one student commented about personal goals of reading, and two students expressed that it helps them reach their personal goals when the teacher talks about something that they like. Students were only a little bit more responsive to this same question during Focus Group Two. Melissa said that 'learning different words and stuff like that... like the Schaffer Paragraph' helps her to reach her personal goals. I asked a follow-up question of the students, saying, 'What topics in the class are important to you?' Carisa said, 'I like when somebody else reads [stories] out loud.' Manuel also added to the conversation, saying, 'I like when we read stories... When they, um, um... sometimes when they are telling the story, I, like, describe it in my head, too.'

ELL Confidence. During both focus groups, students were asked the question: 'How does English class help you to feel more confident communicating in English?' In Focus Group One, Manuel said, 'Oh, like, when we make groups, we have to talk to each other.' Carisa agreed with Manuel saying, 'I was gonna say that.' I asked the students what about group work helped them to feel confident, and Rafe responded, 'It's easy to talk to them.' Melissa also expressed that when she gets good grades, she feels confident. In Focus Group Two, students were asked the same question. Melissa and Carisa both responded, saying that they don't like speaking in front of the class. Manuel also added that if he has to speak in front of the class, he faces the opposite direction, avoiding eye contact with other students. Melissa, Carisa, and Manuel then engaged in a conversation about the difficulty of speaking in front of the class and explained they are afraid that people will laugh if they make a mistake. I then asked the students what would help them feel more confident speaking in front of people. Manuel said, 'if I feel proud of what I did,' it makes him feel more confident about his work. Melissa agreed. Carisa went on to explain that she feels confident about her work when the teacher is next to her because 'when you need help with something, they just help you.'

ELL Satisfaction. Students were also asked the question: 'In what ways are you satisfied with how you are doing in English class?' In Focus Group One, Melissa responded, saying that her grades make her feel satisfied. Manuel responded that satisfaction comes 'when you get a high score... when you feel like you've done good' and when someone 'comments on your work.' In Focus Group Two, Melissa again shared that 'getting good grades' makes her feel satisfied. Manuel expressed that sometimes he likes it when they work alone. Manuel explained, 'I stay focused, like, the whole class time... And when I'm focused, um, sometimes the time goes really fast.' Carisa agreed with Manuel, saying that she felt the same way. Manuel then continued to elaborate on what makes him feel satisfied in the English classroom. He said, 'when we do fun stuff, the time goes so fast.' When I asked Manuel to explain if any of the tasks we did in class were considered fun stuff, he responded quickly, saying 'the story.'

Implications

The findings of this study demonstrate how persistent attention to instructional strategies that provide additional support for ELLs not only benefits ELLs but also benefits NESs. While not all of the elements of the ARCS model of motivation were positively impacted for ELLs by the intervention in this study, the lack of positive impact on confidence suggests that future work should further target this element of motivation. During the focus groups, ELL students made direct references to task-based instruction throughout their conversations. Specifically, they mentioned task-based lessons when they answered questions about their attention and relevance. When it came to satisfaction, students made specific statements about being more satisfied with the class when task-based instruction activities took place. When it came to confidence, students shared that they struggled with confidence in the classroom. This struggle with confidence was also seen in the quantitative data. The student did mention that some of the structures used within task-based instruction – like working in pairs and receiving feedback from the teacher – were helpful to them. However, ELL students still had strong feelings about lacking confidence even after the intervention.

One implication for future practice is to further explore ways to increase ELL student confidence. Analysis of the data collection methods in this study indicated that task-based instruction itself did not significantly increase ELL student confidence. During the focus group, students in this study expressed that they often felt uncomfortable when speaking out loud in front of their peers. Future research could explore strategies for helping ELL students to gain confidence, particularly in their speaking skills. Given the positive outcomes demonstrated in this smaller-scale study, we feel more confident that future studies could explore these improvements with a larger population of students.

Conclusion

Systemic inequities often prevent ELL students from being provided with a democratic, student-centered, inclusive learning environment (Briscoe, 2014; Brooks, Adams, & Morita-Mullaney, 2010; Knudsen, 2009; Marx & Saavreda, 2014; Theoharis & Toole, 2011). As an attempt to address this issue in a specific context, this action research study asked: What is the influence of task-based instruction on ELL student motivation in a grade seven ELA inclusion classroom? The students' motivation was measured according to the four elements of the ARCS model: attention, relevance, confidence, and satisfaction (Keller, 2008). The research question was, therefore, answered by examining ELL students in each of these elements. Using a convergent and parallel mixed-methods design, qualitative and quantitative data were gathered simultaneously and merged in the analysis (Creswell, 2014). Data were analyzed in order to determine the impact of task-based instruction. The results of this study indicated that ELL students showed the highest positive responses about attention and relevance, moderately positive responses about satisfaction, and the least positive responses about confidence. Overall, the findings of this study suggest that ELL students responded positively about the influence of task-based instruction on their motivation.

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MULTIPLE MEANS OF ENGAGEMENT IN ELEMENTARY SOCIAL STUDIES

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Abstract The purpose of this action research study was to determine if implementing select strategies from the Universal Design for Learning (UDL) framework would affect student engagement. This study sought to answer the question: Can the implementation of the UDL framework positively impact student engagement in social studies instruction? Two weeks of traditional instruction were followed by two weeks of instruction utilizing UDL strategies from Principle III: Promote Multiple Means of Engagement in a third grade classroom. Data was collected both quantitatively and qualitatively and analyzed for changes and/or preferences in student engagement relating to instructional style. Comparison of the traditional and UDL segments of instruction found that a larger percentage of students enjoyed and understood the UDL lessons based on student self-reports. Behaviors of engagement were found to vary among individuals.

Keywords: teacher action research, UDL, social studies

Introduction

Engagement is essential for student learning to take place, and, importantly, relates to how well students do in school. As Finn and Zimmer (2012) state, the connection between student engagement and academic achievement “is likely to be reciprocal, that is, high achievement is likely to promote continuing engagement and low achievement is likely to discourage further engagement” (p.123). These findings suggest the need for teachers to consider the importance of fostering student engagement in their classroom.

Student engagement is commonly linked with interest (Fredericks, Blumenfeld, & Paris, 2004; Spencer, 2011; CAST, 2011) and social studies, in particular, has been shown to leave students disinterested (Zhao and Hoge, 2005). While interest is only one of many factors affecting engagement, it presents the problem: what if the student is not interested? In a survey of student interest by subject matter in kindergarten through fifth grade, Zhao and Hoge (2005, p.220) found “students almost universally hold negative attitudes toward social

studies,” which was consistent with previous research findings (Marks, 2000; Schug, 1984). Based upon student and teacher questionnaire responses in their study on perceptions and understandings of social studies, Zhao and Hoge concluded that students have little understanding of social studies content or the importance of learning the subject. The literature also reports that reading and math requirements at the elementary level leave teachers little time to provide quality social studies instruction, leaving the subject marginalized (Boyle-Baise, 2012; Hammond & Manfra, 2009; Zhao & Hoge, 2005). For these reasons, the pedagogies supporting elementary social studies implementation may be in need of transformation.

The following study seeks to investigate student engagement in social studies through the implementation of strategies within the UDL framework. Universal Design for Learning (UDL) is a framework that allows for curriculum access to all learners by providing multiple means of representation, expression, and engagement (CAST, n.d.). This study focuses specifically on strategies within UDL’s third principle, Provide Multiple Means of Engagement. It is our hypothesis that employing UDL strategies (referred to in the framework as checkpoints) within instruction will improve teaching practice by allowing the lead author to address the needs of the widest possible span of learners. Therefore, the research question is: How can the implementation of the UDL framework positively impact student engagement in social studies instruction?

Literature Review

Student Engagement. In the 1980s, student engagement became a greatly debated topic in education as a possible explanation for high rates of students dropping out of school (Finn & Zimmer, 2012). Theorists, such as Jeremy Finn, developed models to explain the relationship between engagement and student achievement (Finn, 1989). It has been found across empirical studies that student engagement is linked to learning and positive educational outcomes, such as graduating from high school (Finn & Zimmer, 2012; Marks, 2000; Rock, 2005).

The term ‘student engagement’ encompasses both observable and non-observable behaviors. Helen Marks (2000) describes engagement as “the attention, interest, investment, and effort students expend in the work of learning” (p. 155). More specifically, Marks further describes engagement from a developmental perspective as a “growth-producing activity through which the individual allocates attention in active response to the environment” (p. 155). Influencing variables on engagement include student choice, reducing threat for students, and rewarding student effort in addition to skill (Spencer, 2011).

Certainly, more abstract variables such as belonging factor into how engaged children are in schooling (Finn, 1989). Jeremy Finn (1989) composed a theory known as the Participation-

Identification model, which he outlined in his seminal work, *Withdrawing from School*. While his work was originally created to explain why students drop out of school (Finn, 1989), his Participation-Identification model has since been used by researchers to support the importance of student engagement in the classroom (Finn & Zimmer, 2012; Marks, 2000). This model is comprised of two components: a student's identification with school and their participation in school activities. Finn states, "students who identify with school have an internalized conception of belongingness... [and] value success in school-relevant goals" (p. 123). The second component of Finn's model, active participation, which for the context of this paper will be used synonymously with student engagement, is defined as "the essential condition for formal learning to occur" (p. 133). Together, the affective factor of identification and the behavioral factor of participation make up a student's overall school experience (Marks, 2000).

Observable behaviors that students display while positively engaged in their learning include, but are not limited to, responding to the teacher, following directions, being prepared for class, and raising a hand to ask and answer questions (Finn, 1989; Guardino & Fullerton, 2010). Finn and Zimmer (2012) expand on these examples to include "the everyday tasks needed for learning," such as attending class, completing in-class and homework assignments, and generally holding a positive attitude about school (p. 98).

Clearly, engagement encompasses both observable and non-observable behaviors. However, in previous research, the factors that were found to positively impact engagement were school-based, within the control of the teacher and/or school. This includes such conditions as a student's positive orientation toward school, authentic learning tasks, a positive and safe school and classroom environment, high expectations held of the students, and parental engagement (Marks, 2000).

In fact, teacher actions play a crucial role in the engagement of students (Baker, Clark, Maier, & Viger, 2008; Skinner & Belmont, 1993). Baker, Clark, Maier, and Viger (2008) state that a teacher's classroom management can impact a student's academic engagement as well. The elements that comprise classroom management include consistent routines, consequences for non-compliance, and holding high expectations for students (Baker et al., 2008). Marks (2000) adds that, in addition to classroom management, a positive school environment, including set expectations for respect, fairness, and safety, impacts student engagement as well. These factors allow students to take responsibility for their own learning, therefore empowering them and intrinsically motivating them, and ultimately keeping them engaged (CAST, n.d.; Katz, 2013; Spencer, 2011).

Student engagement in the classroom has been found to have a direct correlation to student learning and academic achievement (Finn, 1989; Finn & Zimmer, 2012; Marks, 2000). In a review of numerous studies exploring the relationships between student

engagement and educational outcomes, Finn and Zimmer (2012) reported that “Students across grade levels who exhibit academic engagement behaviors, such as paying attention, completing homework and coming to class prepared, and participating in academic curricular activities, achieve at higher levels than their less academically engaged peers” (p. 107). Examples of academic achievement measures in these studies include subject matter achievement tests and teacher-reported rating scales.

Engagement in the Subject of Social Studies. The historical approach to social studies education presents many challenges for students. First, social studies texts can be difficult for students to comprehend because they present substantial amounts of information at one time, incorporate a great deal of academic vocabulary, and are often written above grade level (Ogle, Klemp, & McBride, 2007; Bouck, Courtad, Heutsche, Okolo, & Englert, 2009). Additionally, these texts often contain information that students are not able to connect to, do not find relevant to themselves, and present concepts of which students have no prior knowledge, such as foreign cultures and historical time periods (Henning & Bell, 2011; Ogle et al., 2007). Finally, many teachers use lecture as a traditional format for teaching social studies, which places “less emphasis on higher-order thinking skills...[and] demands greater oral comprehension and processing skills” (Bouck et al., 2009, p. 15). Such demands make social studies an appropriate subject for UDL implementation (Bouck et al., 2009).

Studies have shown student attitudes toward social studies as either negative or indifferent at both the elementary and secondary levels (Zhao & Hoge, 2005; Marks, 2000; Schug, 1984). From their study on K-5 students in Georgia regarding students’ attitude toward and understanding of the importance of social studies, Zhao and Hoge found that students best enjoyed subjects that were fun, challenging, and hands-on. Yet in contrast, most teachers in the study displayed an “over-reliance” on the textbook, which served as the main, if not sole, resource used in social studies instruction (p. 218). Zhao and Hoge’s study provides evidence for the traditional, text-based approach commonly seen in social studies classrooms, and the need for variety in educational methods to make material more interesting and relevant to students. Additionally, the literature provides alternative, student-friendly approaches, including technology integration, authentic learning, and student-created projects and these will now be discussed in further detail.

Technology integration. Internet-based activities, including WebQuests, Internet workshops, access to primary source documents, and virtual field trips provide a wide array of opportunities for social studies educators (Henning & Bell, 2011; Ferster, Hammond, & Bull, 2006; Frye, Trathen, & Koppenhaver, 2010; Stoddard, 2009). With the help of Web 2.0 tools such as blogs, wikis, and audio/ video creation and editing, students can also create products through which they can demonstrate their understanding of topics, and even share ideas with a wider audience than just their teacher and classmates (Frye et al.; Holcomb, Beal, & Lee, 2011).

Authentic learning. Authentic learning provides students with opportunities to engage with personally meaningful and real-world problems (Stoddard, 2009). One such example from Henning and Bell (2011) was a three-week unit that began with a teacher-created WebQuest, followed by classroom visits from community volunteers, and culminated with students volunteering in the community. The researchers found that the students were highly engaged throughout the project, which was an experience that could not be provided through a textbook (Henning & Bell, 2011).

Student-created projects. “Projects” is a broad term that can vary widely in meaning; however, this allows for teacher interpretation and adaptation to meet the needs of the content and his/her students. In Hammond and Manfra’s (2009) description of projects, they emphasize the importance of student choice, “allowing students to exercise their independence and increasing their engagement” (p. 171). The allowance for student choice is a key tenet within the UDL Principle III, Provide Multiple Means of Engagement (CAST, 2011).

The Universal Design for Learning Framework. Traditional approaches to social studies instruction lack engaging methods and authentic opportunities for choice, and pedagogy to help children access the complex text of the discipline. Arguably, all of these variables create barriers to engagement and, ultimately, achievement. Universal Design for Learning (UDL) is a framework that promotes pedagogical choices that remove barriers to instruction making it a promising approach for innovative social studies instruction. UDL began in the field of architecture as an approach to designing public spaces in order to ensure that they were accessible to everyone (Courey, Tappe, Siker, & LePage, 2013). As a response to the growing concept of special education inclusion in the 1990s, the UDL framework was created to make curriculum accessible for students with exceptionalities (Edyburn, 2010; Rao, Ok, & Bryant, 2014). Technology has many affordances that promote the flexibility and adaptability UDL espouses. As such, thoughtful technology integration to provide curricular access to all students is often associated with UDL implementation. All classrooms are inherently diverse, as each is comprised of a different combination of individual learners; therefore, the UDL framework is appropriate to use in the general education classroom in addition to special education and inclusive classrooms (CAST, n.d.; Katz, 2013; Spencer, 2011).

As previously mentioned, the goal of UDL is to minimize barriers and maximize learning for all students. The framework was designed based on the brain’s broad networks of recognition, skills/strategies, and caring/prioritizing (CAST, n.d.). The UDL framework consists of three pillars based upon these networks: representation, action/expression, and engagement (CAST, n.d.; Courey et al., 2013). This study focuses on the principle of engagement, the affective dimension of learning. Courey et al. found UDL allows for a focus on engagement by “stimulating students’ interest and motivation to learn through creative, hands-on, and meaningful instruction” (p. 10). More work supports the positive impact of

UDL on student engagement (Katz, 2013; Spencer, 2011). Katz performed a mixed-methods study to determine whether or not there was a significant difference in students' engagement after implementation of the Three Block Model of Universal Design for Learning, a model designed to aide teachers in using UDL strategies effectively in their classrooms (Katz, 2013). Teachers of the treatment classes had received training on the Three Block Model of UDL instruction and control classes did not implement this model. It was found that the treatment group spent double the time actively engaged than the control group (Katz, 2013, p. 175). As previously discussed, factors that influence student engagement include real-life application tasks, effective learning time, flexible groupings, and student autonomy (Katz, 2013; Fredericks et al, 2004; Spencer, 2011). These factors are directly supported by the UDL guidelines within Principle III (Engagement), including Checkpoint 8.3, *Foster collaboration and communication*, Checkpoint 7.1, *Optimize individual choice and autonomy*, and Checkpoint 7.2, *Optimize relevance, value, and authenticity*.

Overall, there were few empirical studies to be found specifically focused on the engagement of students during a social studies lesson, and even fewer (if any) as a result of the implementation of UDL strategies. This research, studying the effects of UDL implementation on student engagement in elementary social studies, will fill a gap that currently exists in social studies education literature.

Methodology

Project Design. This action research project sought to identify how the implementation of UDL strategies affected student engagement in third grade social studies lessons. In order to best identify changes in student engagement as a result of UDL implementation, the study contrasted two weeks of traditional, text-based instruction with two weeks of instruction incorporating UDL strategies. The two contrasting styles of instruction took place in succession during a four-week social studies unit on citizenship and community in the lead author's third grade classroom. The initial two weeks of instruction were designed based upon traditional instruction techniques. Resources for these lessons included texts from district-adopted ELA materials, site-wide social studies materials, and supplementary activities.

The second two weeks of instruction were designed based upon the guidelines and checkpoints within Principle III of the UDL Framework: Provide Multiple Means of Engagement (CAST, 2011). Instruction focused on the following checkpoints: Optimize individual choice and autonomy (7.1), Optimize relevance, value, and authenticity (7.2), Foster collaboration and community (8.3), and Develop self-assessment and reflection (9.3) (CAST). The guiding question for students during this two-week period was "How can citizens make a difference in their community?" Students were tasked to design a project that would benefit their local community using their personal knowledge, interests, and information from the previous two weeks of instruction. In order to optimize individual

choice, students were able to choose whether they worked alone, with a partner, or in a group of three. Additionally, students had individual choice in the final products that they would be creating to share their project idea with the class.

Site and Participants. The research site for this study was an intermediate elementary school serving grades 3-5 in a rural town in the West Coast region of the United States. The students at this site are primarily White and represent a variety of socio-economic levels. There were twenty-four third graders in the class, eleven boys and thirteen girls, aged eight and nine years old. Three students had IEPs (Individualized Education Plans), for whom there was a full-time classroom aide. There were no EL students in the class. Of the twenty-four students, only nineteen participated in the study, as either the student or the parent declined participation.

Data Collection and Analysis. Multiple data points provide both broad and specific portrayals of the students and their engagement levels throughout the two contrasting styles of instruction. The instruments used for whole-class data collection included a teacher-created subject interest survey and exit tickets, while focal student data was collected through interviews and observations.

Subject interest survey. A brief subject interest survey (Appendix item A) was given prior to and after the action research study. This survey provided baseline data regarding students' attitudes towards social studies in comparison to other subjects. The surveys were grouped based on students' ranking of social studies for the purposes of focal student selection. Once the post-study surveys were collected, this data was entered into a spreadsheet to document differences by student between pre-study and post-study rankings. The ranking changes were analyzed within social studies to create the data shown below in the Findings section.

Exit tickets. Exit tickets were used to track the interest level and content understanding of individual lessons throughout the four-week period. This exit ticket consisted of three pictorial choices (happy face, neutral face, sad face) for both enjoyment and understanding of that day's lesson (Appendix item B). This data was collected to track whole-class levels of self-reported interest and content understanding throughout the study. Exit tickets were categorized and tallied each day they were given, then inputted into a spreadsheet. This data yielded patterns within categories, such as traditional vs. UDL instruction, or overall enjoyment vs. overall understanding.

Qualitative data was collected from three focal students. These students were selected based on their attitudes toward social studies as reported in the pre-study survey. A representative sample was taken to ensure that target students best represented the range of learners in the class. In the pre-study survey, Mary ranked social studies as her favorite

subject (1), Nathan ranked it with a 4, and Kayla ranked it as her least favorite (5) (all student names are pseudonyms).

Observations. The three focal students were observed a total of nine days across the sixteen days of instruction. On these days, three students were observed with notes taken on the observation protocol form throughout the lesson (Appendix item C). The observation protocol named five engaged behaviors and five disengaged behaviors. The listed behaviors of engagement and disengagement were selected to reflect portions of the Student Participation Questionnaire created by Finn, Folger, and Cox (Finn & Zimmer, 2012). Additionally, behaviors on the protocol were selected based on findings from literature on student engagement (Finn & Zimmer, 2012; Finn, 1989; Marks, 2000; Guardino & Fullerton, 2010). An “other” category was provided for any task-specific engaged/ disengaged behaviors that might have been observed. The protocol form also included space for both observational and reflective notes in order to provide context for the observed behaviors for a given lesson.

Data from the observation protocol forms was transcribed into a spreadsheet, one for each of the three students. Columns were designated for each item of engaged and disengaged behaviors, so that checked boxes could be indicated digitally. A column was also added to allow for written teacher comments. Data was examined for patterns between engaged and disengaged behaviors across students and within individuals, as well as among certain behaviors.

Interviews. The three focal students participated in brief interviews prior to beginning the unit and following its conclusion. From the first question (What is your favorite subject in school?), it was hoped to gain insight as to what subject matter, teaching style, or classroom environment was most meaningful to the student. In asking the second question (Do you like social studies? What things do you like/ not like about it?), the authors aimed to understand student perceptions of social studies, and to get insight into content instruction that the student had received in the past. Finally, the third question (In what ways do you learn best?) was an open-ended question that could provide more information about the learning preferences and experiences of the students. The post-unit interview consisted of the same three questions as the pre-unit interview, plus one additional question. In repeating the same questions, the authors sought to analyze changes in student responses to indicate a shift in perception of social studies and potentially the student’s self-awareness of their learning preferences. The fourth question was: “We’ve been studying citizenship and communities in social studies. Tell me about: a. your favorite activity, b. the lesson you learned the most from, and c. your least favorite activity.” This additional question sought feedback on the unit as a whole, as well as an indication of student preferences of either traditional or UDL-based instruction.

Interview data (both pre- and post) was coded for three major themes: attitudes toward social studies, collaboration preference, and instructional style. Both inductive and

deductive coding procedures were utilized when analyzing the interview data (Miles, Huberman, & Saldana, 2014). During the process of deductive coding, potential themes were identified, but were later adjusted to best fit the data once it was collected. Subcodes were developed inductively once data had been collected and patterns began to arise naturally (Miles et al., 2014).

Results

Figures 1 and 2 show changes in how students ranked social studies (1 = favorite, 5 = least favorite) between the pre-unit and post-unit surveys. As indicated in Figure 1, 57.9% of the students ranked social studies in a higher position in the post-unit survey than they did in the pre-unit survey. Figure 2 shows the distribution of these students by the exact number of positions increased. Of those whose preferences increased, 45.4% ranked social studies one position higher than previous, and 54.5% increased the rank of social studies by two or more positions. Three students (15.8% of the population) ranked social studies in the same position on both the pre- and post- surveys. 26.3% of students decreased their ranking position of social studies from the pre-unit survey to the post-unit survey; however, it is important to note that rankings only dropped by one or two positions. For example, two students ranked social studies 5th in the pre-unit survey, and 1st in the post-unit survey, thus increasing by four positions. The opposite of this, a dramatic decrease in preference of social studies, did not occur.

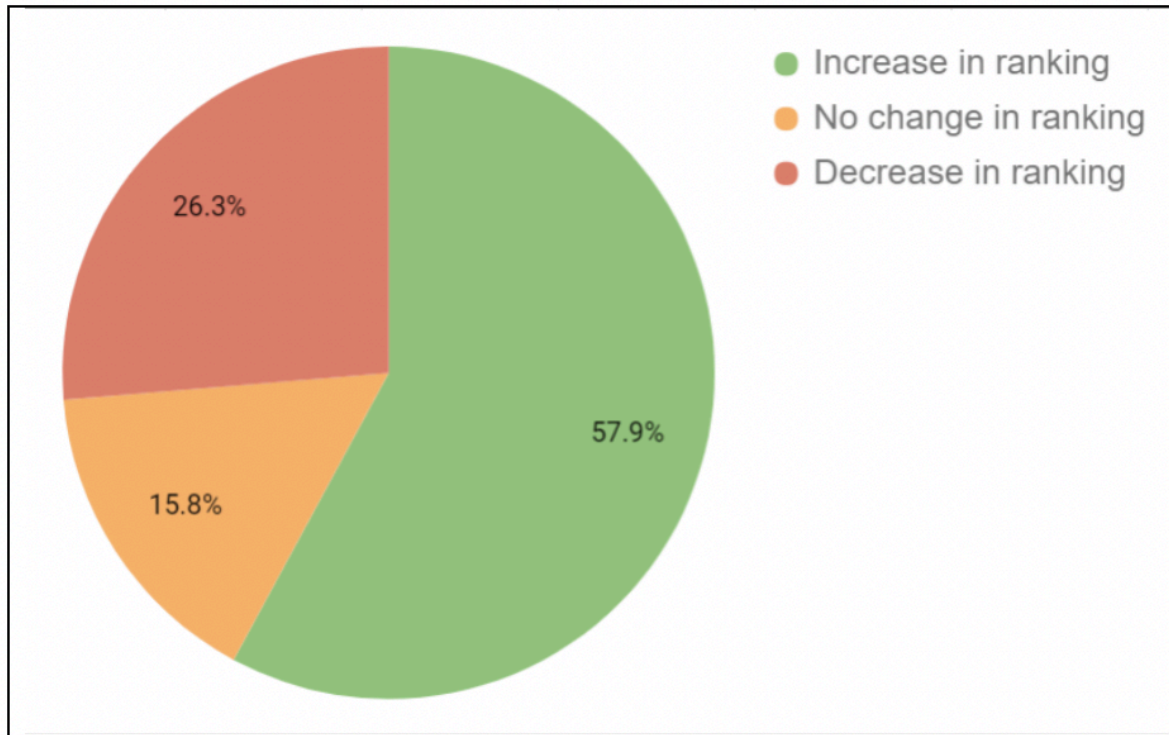


Figure 1. Change in student rankings of social studies as measured by pre- and post- subject interest survey data.

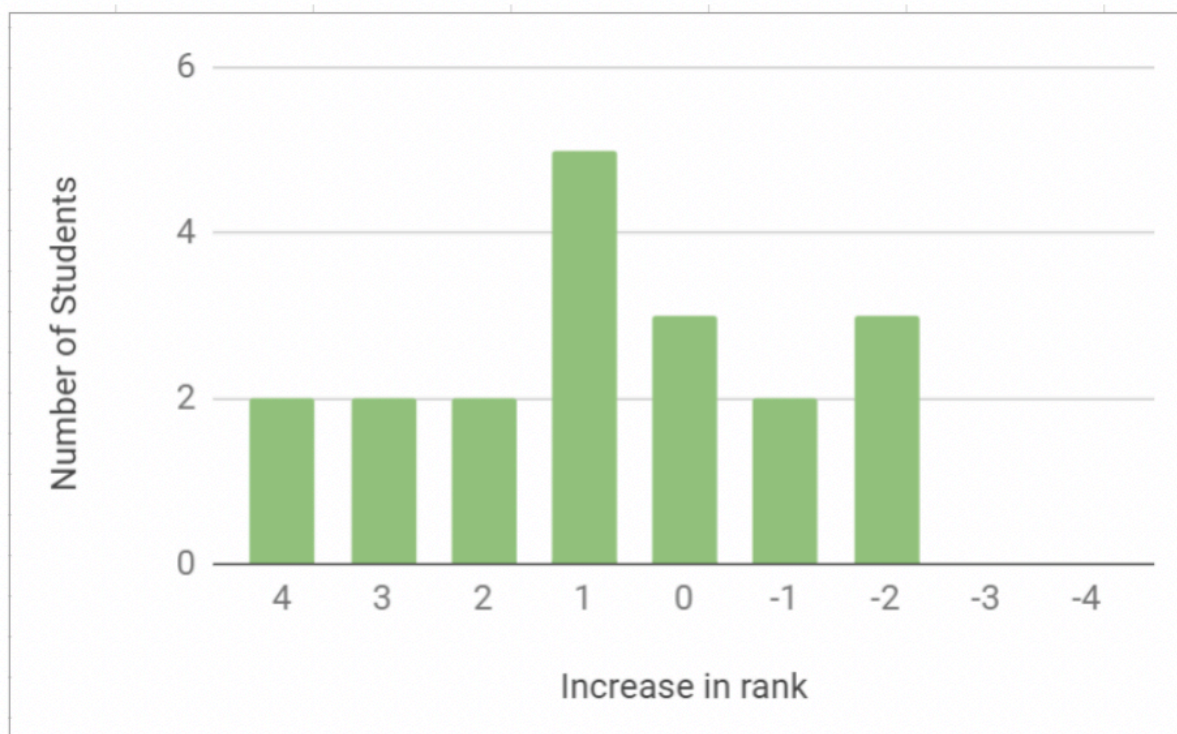


Figure 2. Distribution of student rankings of social studies as measured by pre- and post-subject interest survey data.

Exit Tickets. Student-reported exit ticket data showed that levels of both lesson enjoyment and understanding were elevated during the UDL period of instruction compared to the traditional instruction period. Self-reported enjoyment levels of the students were 10.5% higher during the UDL period of instruction. Students that ranked their enjoyment as “somewhat”, decreased by over half, falling from 17.1% to 8%. Similarly, the percentage of students that ranked their enjoyment as “poor” dropped from 3.4% during traditional instruction to 2% during UDL instruction.

Overall, students self-reported slightly higher levels of understanding than enjoyment during both traditional and UDL instruction. However, similar trends can be seen in levels of understanding as those of enjoyment: there was an increase of “good” responses, and a significant decrease in “somewhat” responses. Self-reports of “good” understanding increased by 8.9%, and “somewhat” decreased by 8.4%, falling from 10.3% in traditional instruction to 1.9% in UDL instruction. Student ranking of “poor” understanding remained relatively unchanged, with 3.4% during traditional instruction, and 2.9% during UDL instruction.

Interviews

Attitudes toward social studies. Initial interview responses to the question “Do you like social studies?” were generally negative or uncertain. All three students’ responses were coded negatively, though two were additionally coded as unclear. Nathan’s responses were not unclear; he generally did not like social studies, particularly because “you have to write a lot,” and he disliked writing. Unclear responses from Mary and Kayla included “I don’t like how if we get something wrong, we have to do it again” and, “Sometimes you might get frustrated and you might have a temper tantrum.” Neither of these responses indicate that the student is specifically referencing social studies in either content or context. Additional responses that indicate an overall lack of previous social studies knowledge include, “I like the word” (referring to the term ‘social studies’). Kayla directly asserted a lack of familiarity with the subject, stating, “We haven’t really learned social studies.”

In contrast, all three focal students responded with either all or partially positive remarks in the concluding interview. Such positive remarks included Kayla stating, “I like everything,” when asked what she did not like about social studies. Positive remarks also included references to the community project (part of the UDL instructional segment), such as, “You get to work with a partner,” and “You get to help the environment.” Nathan’s attitude toward social studies in the post-unit interview was slightly more positive than his initial because of his response that he “kind of” liked social studies, in comparison to initially “not really” liking social studies.

Collaboration preference. In the initial interviews, all three students indicated a preference for working with or learning from others. In her reasoning for why writing was her favorite subject, Kayla responded, “It’s fun to do with other friends.” When asked about ways in which they like to learn, Nathan stated that he learned from his friends, and Mary replied that she learned from family members, such as her sister. Additionally, Nathan stated that he also learned by reading non-fiction books. This response was coded for preferring to work/ learn independently.

In the post-unit interviews, Nathan no longer mentioned working with others as a preferred method. When asked how he learned best, he said that he liked a quiet environment, and that “I usually work the best when I work alone, but sometimes if I can’t work alone, it doesn’t really help.” However, both girls responded positively in regard to working with partners in their post-unit interviews. The post-unit responses regarding collaboration preference aligned with the choices each student made while working on the community project. Nathan chose to complete the project by himself, while both Mary and Kayla chose to work with a partner.

Instructional style. Student responses to question four of the post-unit interview were coded negatively and positively for both UDL and traditional styles of instruction. This question required students to reflect on the previous four weeks, including favorite and

least favorite activities. Kayla's responses referred to activities from the traditional instruction segment as both her favorite and from which she learned the most, and she claimed to not have any least favorite activities. Nathan and Mary replied that "making the poster" was their favorite activity, which was positively coded for UDL. When asked about the activity from which he learned the most, Nathan responded, "I don't really know." Mary's responses were coded both positively and negatively for UDL, as she cited activities from this segment for all three parts of the question; she did not refer to activities within the traditional segment at all.

When reviewing the responses altogether, they can be organized by instructional style. Traditional instruction was referred to positively on two occasions and referred to negatively once. UDL instruction was mentioned positively three times, and negatively once. Individual preference and variation should be noted. There was some overlap, such as Mary and Nathan both referring to making posters as their favorite activity. On the other hand, an activity from the traditional instruction segment was cited by Kayla as her favorite activity, and by Nathan as his least favorite.

Student Observations. Engaged behaviors, and the percentage of lessons in which they were observed, varied by individual. Over the course of all nine observed lessons, Nathan and Mary did not display any disengaged behaviors. Furthermore, these two students were observed following directions in all observed lessons. Kayla followed directions in eight out of nine lessons. Mary was also observed asking and answering questions in all observed lessons. In contrast, Nathan displayed this behavior in only three out of eight observed lessons. Kayla displayed disengaged behaviors on two out of the nine observed days. On both occasions, the disengaged behaviors that she displayed were being distracted and disrupting the work of others. Of the five engaged behaviors listed on the protocol, Mary displayed an average of four engaged behaviors per lesson, and Nathan and Kayla each displayed an average of three engaged behaviors per lesson.

Observational data on behavior also allowed the authors to determine how student behaviors relate to the ways in which they interact with others. For example, one of the engaged behaviors on the observation protocol was "interacts appropriately with peers for a given task." Both Mary and Kayla were observed displaying this behavior in six of the nine observations, while Nathan displayed this behavior on only four of the eight days that he was observed. Teacher comments on the observational protocol were coded for working preferences as well. These comments were written notes that provided more detail and context regarding the student's behaviors. Comments were made regarding Mary's partner work in three of the nine observations, while none were made about her working independently. Comments were given about Kayla's working with others three out of nine days, with one comment pertaining to Kayla working independently. Conversely to the girls, comments regarding Nathan working with others were made only once, and comments regarding him working independently were made on three out of eight observations.

Discussion

The focus of this study was to better understand how the implementation of UDL strategies impacted student engagement in social studies instruction. The findings showed an overall increase in student interest in social studies after implementation. Specifically, self-reports from students indicated higher levels of interest and understanding during the UDL segment of instruction when compared to the traditional segment of instruction. But what does that mean for engagement?

In their article discussing the potential and evidence for student engagement, Fredericks, Blumenfeld, and Paris (2004) describe the concept of engagement as “theoretically messy” (p. 84). This ‘messiness’ has been attributed to engagement’s overlap with similar constructs, the breadth of the topic, and the difficulty in measuring the construct (Fredericks et al., 2004; Fredericks & McColskey, 2012). It was also difficult to measure student engagement in this study, even with the use of multiple methods, as the research suggested (Fredericks & McColskey, 2012). Based on the engaged behaviors listed on the observation protocol, it was challenging to discern the degree to which the individual was or was not truly engaged in the lesson. For example, Nathan followed directions during all eight observations, but was only observed asking and/or answering questions on three of those eight days. Does this mean he was not engaged the other five days, or is he simply a student that is less likely to contribute to class discussions? These types of “messy” questions presented themselves while reviewing the observation data.

The data shows that students had higher levels of interest and enjoyment when the social studies lessons incorporated UDL strategies when compared with traditional instruction. Student interviews and observations suggest that a possible factor for increased interest and enjoyment was student choice regarding multiple aspects of their work, including collaboration preference and project selection. Providing such choices are strategies that support UDL Checkpoint 7.1, ‘Optimize individual choice and autonomy’. Personal choice has shown to increase motivation, perceived control, and confidence for a given task (Tafarodi, Mehranvar, Panton & Milne, 2002). These research-based conclusions support the results of this study. Conversely to the lessons in the UDL segment, the traditional instructional segment did not provide any room for personal choice; rather, students were given a directive regarding how a task must be completed. Student choice does not comprise the entirety of UDL’s principle of engagement, but it is a starting point for UDL implementation that provided a noticeable contrast to traditional instruction, to which students responded positively.

Pre-study survey and interview data showed negative and unclear student perceptions of social studies, consistent with previous research (Zhao and Hoge, 2005; Marks, 2000; Governale, 1997; Schug, 1984). However, it is a possibility that students’ negative responses toward social studies were not all coming as a result of dislike, but rather a lack of knowledge of the topic. When administering both the interviews and the surveys, it was clear that some students did not have a clear understanding of what social studies was, and

even stated that they hadn't learned it in previous years. Without insight from teachers at the primary grade levels, it is difficult to determine how much exposure to social studies these students received in earlier grades. The concept of social studies being left out of elementary curriculum due to the push for core subjects is not a new one, particularly in the primary grades (Boyle-Baise, 2012; Thornton & Houser, 1996; Zhao & Hoge, 2005). Therefore, it was encouraging to see multiple data measures (surveys and interviews) indicate a more positive attitude toward social studies at the conclusion of the four-week unit.

Implications

This research has made a case for the implementation of UDL practices, specifically within the principle of engagement, as a method to improve student engagement in elementary social studies. The lessons in which UDL strategies were used yielded a higher percentage of student enjoyment and understanding than lessons following traditional instructional practices. Additionally, students indicated an increased preference for social studies after the conclusion of the four-week study. Finally, the observation of focal students led to a hypothesis that engagement presents itself differently across individuals.

One clear takeaway from this study is the positive student response to the UDL strategies regarding choice and authenticity. Students most enjoyed the lessons in which they could choose how they learned (such as groupings) and which topic to further investigate. This element of providing choice can aid in a student's confidence and motivation (CAST, 2011; Tafarodi et al., 2002), and for this reason, UDL checkpoint 7.1 would be a great start for other educators who wish to pursue the implementation of UDL in their classrooms.

One limitation of this study was the relative homogeneity of the selected focus students. More varied data in terms of engaged and disengaged behaviors could have been seen had there been different students selected, or if more than three students had been selected for observation. Based upon the selected focal students in this study, it was difficult to determine much of an increase in specific engaged behaviors observed between the traditional and UDL segments of instruction. Also, due to the lack of control group and researcher-created instruments, the generalizability of this work is limited. Despite these limitations, the knowledge of how to determine behaviors of engagement and the understanding that these observable behaviors are likely to differ between individuals is helpful in classroom practice.

Conclusion

Based on the outcomes of this study, further research is needed in the area of student engagement in elementary social studies. This study showed an overall increase in student interest in social studies, specifically with higher levels of enjoyment when UDL strategies were employed. However, interest and enjoyment are not the only factors of student engagement. We believe the areas of specific, observable behaviors of engagement warrant

further study, as that data was the least decipherable from this research. Additionally, this study did not examine engagement data with academic outcomes, which is important to consider before generalizing positive results.

It is our hope that this research provides new avenues and insights into engagement strategies for elementary students, particularly in the subject of social studies. The question of how to best engage students will continue to be a question with no single right answer, as all students are unique learners. Elementary classrooms are going to continue to house a population of students with highly diverse needs. Designed for the purpose of meeting the needs of all learners, the strategies of the Universal Design for Learning Framework are one set of tools that a teacher can employ when setting themselves the task of improving student engagement.

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Appendix A: Subject Interest Survey

Name_____

Rank these subjects according to how much you like learning about them in school.

Each subject must have a different number (1, 2, 3, 4, 5).

1 = This is my favorite subject.

5 = This is my least favorite subject.

____ Math







____ Social Studies

____ Writing

____ Science

____ Reading

Appendix B: Daily Student Exit Ticket

Exit Ticket		
Name _____		
Did you enjoy today's lesson?		
		
Did you understand today's lesson?		
		

Appendix C: Student Observation Protocol

Student Engagement Observations

Name _____ Date _____

Lesson: _____

Engaged Behaviors Observed		Disengaged Behaviors Observed	
	Asks/ answers relevant questions		Doesn't participate in class discussion
	Follows directions		Misses some or all teacher directions
	Looks at teacher while speaking		Distracted (i.e. looks around/away, talks to neighbors)
	Completes assignments		Disinterested (i.e. lays head on desk)
	Interacts appropriately with peers for a given task		Disrupts the work of others
	Other:		Other:

Descriptive Field Notes	Reflective Field Notes

