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Effect of Hands-on Learning on Short-Term Retention in Third-Grade Students

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As research in the field of active learning has grown, so has its list of meanings. Active learning has become an all-encompassing term that has been based largely on peoples' intuitive understanding of the term rather than any universal definition (Bromwell & Eison, 1991). To address this issue, Bromwell and Eison (1991) defined active learning as "instructional activities involving students in doing things and thinking about what they are doing" (para. 1). However, this is still a very inclusive definition that allows for a multitude of teaching methods, ranging from pausing briefly during lectures so students can discuss their notes (Ruhl, Hughes, & Schloss, 1987) to having students physically running around, playing a game (Humphrey, 1969).

Given the broad range of activities that are included under the term active learning, it is, perhaps, unsurprising that studies examining the effectiveness of active learning techniques have yielded inconsistent results. In some studies, active learning and traditional learning have been shown to yield similar outcomes (Lopata, Wallace, & Finn, 2005). In other studies, active learning has been shown to yield better outcomes than traditional learning (Humphrey, 1969; Ruhl et al., 1987; Mayer, 2004; Hammett, 2010), though different studies focus on different types of active learning. One distinction that has been made in the literature is between behavioral active learning and cognitive active learning. Behavioral active learning involves activities that engage the body, such as dancing or running around; cognitive active learning, on the other hand, involves activities that engage the mind, such as class discussions and taking notes. Unfortunately, even here, recommendations are mixed; some researchers argue for a more behaviorally active approach (Humphrey, 1969; Hammett, 2010), while others argue for a more cognitively active approach (Ruhl et al., 1987; Mayer, 2004).

Because of these mixed results and because so many different types of active learning fall under Bromwell and Eison's (1991) definition, no concrete conclusions about its success or failure as a whole can be drawn from the hodgepodge of research. Although researchers are working on what is nominally the same topic, they are not actually exploring the same phenomena at all (Michel, Cater, & Varela, 2009). Michel, Cater, and Varela (2009) explain, "Researchers and educators are free to use a plethora of activities that qualify as active learning, making the comparison of studies very difficult. It could very well be the case that only certain aspects of what educators identify as active learning actually improve learning outcomes" (p. 414).

Because there are no clear conclusions about the success or failure of active learning as a whole, yet a wide array of active learning techniques are used in the classroom, it is important to discover which active learning methods do work. Rather than making claims about the general term active learning, it is necessary that the term be broken down into categories that can be studied to find out exactly which active learning methods are beneficial in the classroom. A type of active learning that embraces strengths of both behavioral active learning and cognitive active learning is hands-on learning (Korwin & Jones, 1990). Hands-on learning involves hands-on activities incorporated into the lesson that act as physical tools to help explain and teach a concept to students. For example, students learning verbs might be given a game piece that they would use to physically represent a given verb; if the verb was 'jump,' the students must make their game piece jump. The students are physically manipulating the game piece with their hands to learn verbs. Hands-on learning differs from the more extreme behavioral types of active learning, such as playing a game of Verb Tag, in which students must

enact the given verb (e.g., jump) while trying to get away from the student that is 'it.' Hands-on learning also differs from simpler cognitive types of active learning, such as discussing in class what verbs are and then having students come up with their own examples of verbs. On the active learning continuum, hands-on learning falls somewhere in the middle, located between the more extreme behavioral and cognitive types of active learning.

Hands-on learning captures positive qualities of both behavioral active learning and cognitive active learning. One positive quality of behavioral active learning that is captured in hands-on learning is that it naturally evokes more interest and enjoyment in students than cognitive active learning does. According to Humphrey (1969), "Active games, because of their very nature, are more likely than traditional learning activities to be structured in a way that the child's interest is held" (p. 22). Hands-on learning, because it involves the physical manipulation of objects, draws on the interest factor of behavioral active learning—though to a lesser degree—satisfying the need for behavioral engagement and thus naturally keeping students interested and involved. Supporting this theory of greater interest and enjoyment in hands-on learning, satisfaction ratings have shown that students tend to express more enjoyment and satisfaction from hands-on learning than traditional learning (Walberg, 1986).

One positive quality of cognitive active learning that is also captured in hands-on learning is that it encourages students to be more mentally engaged than behavioral active learning does. In fact, lack of mental engagement during behavioral active learning has been a common criticism against it in previous literature (Kolb, 1984). Traditional classrooms are structured in a way in which cognitive active learning is used, including such methods as discussion, use of visual aids, etc. However, children often have short attention spans and

quickly lose interest during pure cognitive active learning. Hands-on learning, though, engages students mentally as they conceptualize abstract lessons through the use of relevant concrete objects and activities. Hands-on learning, then, draws on the interest factor of behavioral active learning and the mental engagement factor of cognitive active learning, providing a more integrative, holistic approach than either of the two extremes.

Hands-on learning also captures the practicality of cognitive active learning in that it is more applicable in a typical elementary school classroom than extreme types of behavioral active learning. The setup of most elementary school classrooms does not leave a large space available for an abundance of physical activity, such as games that involve running. However, cognitive active learning, which involves mostly sitting at a desk and actively thinking, is easily accomplished in the classroom. Like cognitive active learning, hands-on learning can be accommodated to a typical classroom because students can participate in hands-on activities while remaining at their desks or coming together in small groups. Hands-on learning incorporates the applicability of cognitive active learning, making it a practical and feasible learning approach.

Not only does hands-on learning draw on positive qualities of more extreme types of behavioral and cognitive active learning, but it also supported by Piaget's theory of the stages of cognitive development, specifically his theory that children from ages seven to twelve are in the concrete operational stage. In the concrete operational stage, children are able to "reason logically about concrete objects and events" (Siegler, Deloache, & Eisenberg, 2006, p. 133). While they are able to think and reason about concrete objects and events, children in this stage still have trouble thinking and reasoning about abstract ideas. This theory of the concrete

operational stage suggests, then, that children between the ages of seven and twelve—approximately between second grade and seventh grade—learn better by using concrete objects and events rather than referring to abstract ideas. Hands-on learning, which allows children to learn through the use and manipulation of concrete objects and activities, seems to be an appropriate and logical extension of Piaget’s theory.

Much of the previous literature focuses on various types of active learning, but few studies focus specifically on hands-on learning. One study that does focus on hands-on learning was done by Ward, Sadler, and Shapiro (2008), who found that hands-on learning groups significantly outperformed traditional learning groups in an astronomy curriculum. In the study by Ward et al. (2008), approximately 750 third- through sixth-grade students were assigned as the hands-on group. Using the Astronomy Resources for Intercurricular Elementary Science (ARIES) curriculum, they participated in hands-on activities relating to exploring the concepts of time, light and color, and the earth in motion. Approximately 650 fourth- through sixth-grade students were assigned as the traditional group; they were taught the same three topics using traditional methods. Results showed that students in the hands-on ARIES group performed significantly better on post-tests, which consisted of open-ended questions about the topics covered, than students in the traditional group (Ward, Sadler, & Shapiro, 2008). This study suggests that hands-on learning is more beneficial than traditional learning and therefore provides support for the implementation of hands-on activities into the traditional classroom curriculum. However, open-ended questions are not typical of standardized assessments, and there is a debate over whether non-traditional approaches to learning, such as hands-on learning, would lead to gains on standardized assessments.

Saunders and Shepardson (1987), though, show support for hands-on learning over traditional learning with regards to performance on standardized assessments. Saunders and Shepardson (1987) assigned sixth-grade students in introductory science classes to concrete instruction and formal instruction groups, which are comparable to hands-on and traditional groups, respectively. Students in the concrete instruction group were taught using hands-on activities, namely laboratory experiments involving “observation, measuring, and investigating” (p. 43). Students in the formal instruction group were taught using verbal and written formats of instruction, such as “lecture-discussion, oral quizzes, written assignments, reading assignments,... and written tests and quizzes” (p. 42). The study ran for a full school year. Pre-tests and post-tests were given, consisting of Lawson’s Classroom Test of Formal Reasoning (1978), which measured cognitive development, and seven tests covering general science curriculum, which measured science achievement. In terms of science achievement, results indicated that students in the concrete instruction group significantly outperformed students in the formal instruction group. Likewise, in terms of cognitive development, results indicated that students in the concrete instruction group had significantly greater cognitive gains than students in the formal instruction group (Saunders and Shepardson, 1987). This study indicates that, even on standardized assessments, hands-on learning is more beneficial than traditional learning.

Further supporting hands-on learning, Korwin and Jones (1990) also found that students in hands-on learning groups outperform students in traditional learning groups on initial recall of information. Korwin and Jones (1990) divided eighth-grade students into a hands-on group and a traditional group. Students in the hands-on group did a reading assignment and then

participated in a hands-on activity, which consisted of building a model geodesic dome which they were learning about. Students in the traditional group did the same reading assignment and then were given an illustrated lecture, which included slides with pictures and examples of the construction of a geodesic dome. Like the previous two studies, students in the hands-on group performed significantly better than students in the traditional group on tests reflective of standardized and open-ended assessments given one day later (Korwin & Jones, 1990).

In light of these studies (Saunders & Shepardson, 1987; Korwin & Jones, 1990; Ward, Sadler, & Shapiro, 2008) and based on our understanding of Piaget's theory of the concrete operational stage, we believe that children will learn lesson material better when taught using hands-on learning rather than traditional learning. Participants will be assessed in two ways. First, participants will respond to questions similar to those they might encounter on a standardized test. Second, participants will respond to open-ended questions more applicable to the real-world. The reason for assessing the participants on real-world applicability is that standardized assessments may not be targeting the knowledge obtained through hands-on learning. Some studies have shown that active learners perform similar to or not as well as traditional learners on standardized assessments (Lopata et al., 2005). They may not be performing as well as traditional learners on standardized assessments because, unlike traditional learners, they are not being taught in the same format as the test. Therefore, in our study, both the traditional and hands-on groups will be taught in a format similar to the standardized assessment, giving both groups a more equal opportunity for achievement on the standardized assessments. Also, hands-on learners may benefit in other areas. Authentic assessments, which include open-ended questions, may capture the knowledge obtained

through hands-on learning because, rather than assessing “low-level, literal questions and specific skills” (Herman, Aschbacher, & Winters, 1992, as cited in Pearson-Prentice Hall, n.d.) like standardized assessments, authentic assessments “imitate tasks and situations potentially found in the real-world” (Pearson-Prentice Hall, n.d.). Authentic assessments require students to perform and/or produce knowledge rather than reproduce information they have memorized (Stefonek, 1991). Most studies focus on just one type of assessment, but by using authentic assessments as well as standardized assessments, we will be able to see which type(s) of knowledge each group acquires and be able to compare the levels of acquisition of those types of knowledge.

All the previous literature on active learning, and even the small selection on hands-on learning, employ different approaches and different assessments and yield different results; therefore, they cannot all be combined and compared, and no solid conclusions can be drawn. In our study, however, we will focus specifically on hands-on learning and include both standardized and authentic assessments; therefore, we will be able to more accurately compare hands-on and traditional groups for both types of assessments and draw more solid conclusions.

Because the hands-on and traditional groups in this study will both be equally taught in a format to the standardized assessment and because research on hands-on learning indicates that students in hands-on learning groups outperform students in traditional learning groups on standardized assessments (Saunders & Shepardson, 1987; Korwin & Jones, 1990), we hypothesize that participants in the hands-on group will have higher scores on standardized assessments than participants in the traditional group. Also, because participants in the hands-

on group will be physically interacting with concrete examples, it should be easier for them to transfer their experience to concrete, real-world situations. Their learning experience is more reflective of situations they could potentially encounter in the real-world. Therefore, we hypothesize that the hands-on group will also achieve higher scores on authentic assessments than participants in the traditional group. Finally, due to Humphrey's (1969) claim that active learning keeps children interested and involved, we hypothesize that participants in the hands-on group will rate the lessons as more satisfying than participants in the traditional group.

To test these hypotheses, we conducted a study in which students in third grade classrooms participated in either one hands-on or one traditional Language Arts lesson per week for three weeks. Each group was evaluated using two types of assessments: a standardized assessment, reflective of a typical elementary school assessment, and an authentic assessment, designed to assess real-world application. Each assessment was administered one week after each lesson to measure short-term retention. Also, a satisfaction questionnaire was given at the end of each lesson.

Methods

Participants

Participants in this study included 72 students (8 to 10 years old) from four third-grade classes at Southwestern Elementary School in Hanover, Indiana. Two of these classes served as the hands-on learning group; the other two served as the traditional learning group. Due to participants being absent, the total number of participants varied each lesson. In total, though, there were 38 participants (47% female) in the traditional group and 34 participants (56%

female) in the hands-on group. Ninety-five percent were White and 5% were African American in the traditional group, while 91% were White, 6% were Hispanic, and 3% were African American in the hands-on group. A convenience sample was used, as we only opened the study to those four third-grade classrooms and included only those students who provided and whose parents provided consent.

Materials

Setting. This study was conducted in typical elementary school classrooms. Each class was taught in their home classroom, and their teacher was present during the study.

Academic Assessments. The tests used were designed by the researchers. There were two assessments each week used to evaluate short-term retention. One was presented in a standardized test format, reflective of typical elementary school assessments (See Appendices A, B, and C). This type of assessment was used to measure the students' abilities to apply what they learned in a standardized test scenario, because that is the type of assessment widely used to assess students' achievement. The other type of assessment was an authentic assessment, designed to measure the students' abilities to use what they learned on a problem more applicable to the real-world (see Appendices D, E, and F).

Satisfaction Questionnaire. A questionnaire was used to assess student satisfaction with each lesson. The questionnaire asked students to rate how much they liked the lesson on a scale from one (not at all) to five (a lot) (see Appendix G). Basic demographics were also asked (See Appendix H).

Procedure

Parents of all students in the third grade were asked to give passive consent for their child's participation prior to beginning the study (see Appendix I). Passive consent was obtained from 87% of parents. Students were asked to give active assent (see Appendix J). All students who received parental consent did so.

There were two hands-on groups and two traditional groups. Each researcher taught one hands-on group and one traditional group to control for experimenter effects. Lessons consisted of three different Language Arts topics, a different lesson taught each week for three weeks. Lessons were chosen based on current third-grade curriculum.

The first week, students filled out demographics. Each group was then taught a lesson on idioms. Both the hands-on and traditional groups were asked what the phrase "It's raining cats and dogs" meant. After discussing the meaning of the phrase, they were told that it was an idiom and that idioms are phrases or sentences that do not mean exactly what they say; they have both a figurative and a literal meaning. Researchers then pointed out which was the figurative meaning and which was the literal meaning, explaining both concepts to the participants. Following this explanation, the participants were read *Even More Parts: Idioms from Head to Toe* by Tedd Arnold. The figurative and literal meanings were pointed out for the first four idioms in the book. Participants were then asked what the figurative meanings were for various idioms throughout the book. After the book was read, the traditional group was given verbal examples of idioms, and volunteers verbally expressed the literal and figurative meanings. Rather than simply verbally giving answers after the completion of the book, though, the hands-on group was given verbal examples of idioms and drew pictures illustrating the

literal meaning. Participants were then able to volunteer and share what they had drawn. The figurative meanings were verbally discussed.

Adjectives were taught in the second week. At the beginning of the lesson, both the traditional and hands-on groups were asked to describe an ice cube. The hands-on group, however, actually passed around an ice cube, giving words to describe it after they had touched it. The researchers then explained to both groups that adjectives are words that describe nouns, using the adjectives the participants used to describe the ice cube as examples. Both groups were also told that adjectives are words that describe how something smells, tastes, sounds, feels, or looks. Once the concept of adjectives was explained, researchers wrote nouns on the board (i.e., marshmallow and basketball) and asked for adjectives to describe the nouns and wrote them on the board. Besides the physical manipulation of the ice cube in the hands-on group, both groups were taught the same way up to this point. The activity phase of the lesson, however, differed between the groups. The traditional group participated in an activity called “Name that Noun,” in which four participants were chosen to look at a noun written on a piece of paper. Each of the four participants were asked to come up with one adjective to describe the noun, and after the four adjectives were said, the rest of the participants were asked to guess what the noun was. Four new participants were chosen for each of five nouns (i.e., quarter, feather, water bottle, tennis ball, and pencil). The hands-on group did a similar activity; however, their activity involved physically manipulating the five nouns in the Adjective Box. The Adjective Box is a shoebox with a hole, big enough for a hand to fit in, cut into the side. Objects, unseen by the participants, were placed in the box one at a time. Four participants were chosen to stick their hands in The Adjective Box and use one word to describe

the object in the box. After four participants had described the item, the other participants tried to guess what the item in the box was. This process was repeated five times, with the same five nouns as were used in the traditional lesson.

The participants were taught adverbs in the third week. Adverbs were explained to both the traditional and hands-on groups as words that modify verbs by telling how something is done, when something is done, or where something is done; they include most words ending in -ly (e.g., beautifully; quickly), comparative words (e.g., more; most; less; least), and words ending in -er and -est (e.g., faster; hardest). Both groups were then read ten sentences, one at a time; they named the adverb in the sentence and answered if the adverb was telling how, when, or where something was done. Following this practice, the traditional group came up with adverbs that modified verbs, verbally discussing the answers. The hands-on group, however, sat in a circle and volunteered adverbs that modified verbs, answering how, when, or where, and then applied the adverb to how they passed a ball around the circle. For example, “quickly” answers how the ball should be passed; once the adverb was volunteered, the ball was passed quickly around the circle. Researchers sometimes helped come up with adverbs for both groups.

After the lessons were taught each week, participants in all groups filled out the satisfaction questionnaire. Starting the second week, participants were reminded of the topic of the previous week’s lesson, told to use what they had learned in the lesson, and then given two different assessments, one standardized and one authentic. The order of the assessments was alternated between classes each week. This process was carried out again in week three,

and then, in week four, researchers returned to the school to administer the tests, although no lesson was taught that week.

Each lesson lasted approximately 20 minutes. Participants were given a total of 20 minutes to complete the short-term assessments. At the end of the study, participants were given a written debriefing form, which included what researchers were trying to monitor, (see Appendix K) and then thanked for their participation.

Results

In this study, participants were taught one Language Arts lesson each week for three weeks. One week following each lesson, participants completed both a standardized and an authentic assessment over the lesson material. They also filled out a satisfaction questionnaire after each lesson.

Effect of Hands-on Learning on Short-Term Retention

The hypothesis that participants in the hands-on group would have higher scores on the standardized assessments than participants in the traditional group was tested using an independent-samples *t*-test. Separate tests were run for each of the three standardized assessments (i.e., idiom, adjective, and adverb). The means and standard deviations for all standardized assessment measures are included in Table 1. For the idiom standardized assessment, there was no significant difference in scores between the traditional and hands-on groups, $t(59) = 1.760, p = .084$. Likewise, there was no significant difference in scores on the adjective standardized assessment between the two groups, $t(59) = .350, p = .728$, nor for the adverb standardized assessment between the two groups, $t(61) = -.724, p = .472$ (see Figure 1).

To test the second hypothesis that the hands-on group would also achieve higher scores on authentic assessments than participants in the traditional group, each authentic assessment was given two scores, and an independent-samples t -test was used to compare both of the authentic assessment scores in both groups. The means and standard deviations for all authentic assessment measures are included in Table 2. The first idiom authentic assessment score, labeled as idiom 1, was the number of correctly identified idioms out of the four possible idioms on the assessment. There was no significant difference in scores between the traditional and hands-on groups, $t(59) = -1.038, p = .308$ (see Figure 2). The second idiom authentic assessment score, labeled as idiom 2, was the number of correctly identified idioms out of the total number of phrases the participants marked. Again, there was no significant difference in scores between the two groups, $t(59) = -1.263, p = .212$ (see Figure 3). The first adjective authentic assessment score, labeled as adjective 1, was the number of correctly identified adjectives out of the total number of words marked. The first adverb authentic assessment score, labeled as adverb 1, was measured the same but with adverbs. There was no significant difference in scores between the two groups for adjectives, $t(57) = .438, p = .663$, or adverbs, $t(60) = 1.404, p = .165$ (see Figure 2). The second adjective and adverb authentic assessment scores, labeled as adjective 2 and adverb 2, were the percentage of adjectives and adverbs used, respectively, out of the total number of words. Again, there was no significant difference in scores between the two groups for adjectives, $t(67) = -.132, p = .896$, or adverbs, $t(60) = 1.908, p = .061$ (see Figure 3).

Satisfaction

To test the hypothesis that participants in the hands-on group would rate the lessons as more satisfying than participants in the traditional group, again, an independent-samples *t*-test was used. The means and standard deviations for all satisfaction measures are included in Table 3. Consistent with our hypothesis, participants in the hands-on group gave significantly higher satisfaction ratings for the adverb lesson than participants in the traditional group, $t(63) = -2.42$, $p = .02$. No significant differences were found in satisfaction ratings for the idiom lesson, $t(67) = 1.33$, $p = .19$, or the adjective lesson, $t(67) = .476$, $p = .091$ (see Figure 3).

Discussion

Although no significant differences were found to support our hypotheses that participants in the hands-on group would outperform participants in the traditional group on both standardized and authentic assessments, the lack of significant differences shows that they also did not perform significantly worse. In other words, although the hands-on method did not help the students, it also did not hurt them. Additionally, the hands-on group enjoyed the lessons significantly more in one out of three cases.

Our finding that participants in the hands-on group did not significantly outperform participants in the traditional group is inconsistent with previous research on hands-on learning. As mentioned in the introduction, research supports that participants in hands-on groups outperform participants in traditional groups on both standardized and authentic assessments (Saunders & Shepardson, 1987; Korwin & Jones, 1990; Ward, Sadler, & Shapiro, 2008). Our study may have yielded results that were inconsistent with this previous research for two main reasons. Firstly, the length of the study may be an important factor in determining the

effectiveness of hands-on learning. The studies by Saunders and Shepardson (1987) and Ward, Sadler, and Shapiro (2008) were conducted over a much longer period of time than our study. In both of their studies, participants were taught using the hands-on method for a full school year. In comparison, our study lasted only three weeks. Researchers suggest that students adapt to learning styles partially as a result of long-term exposure to those learning styles (Nulty & Barrett, 1996). A longer study, therefore, may be more effective in allowing students to get used to learning using a hands-on method. In contrast, the shorter time-frame of our study did not give students a chance to adapt to the hands-on learning style. Once students are adapted to this method, they may outperform students who are taught in a more traditional manner.

Secondly, the curriculum used in hands-on research may be a factor in its effectiveness. Much of the previous research on hands-on learning has focused on science curriculum. Our study, however, focused on Language Arts. Supporting this idea of curriculum-based effectiveness, some researchers suggest that no single learning style is overall superior to others; rather, they propose that different types of information are best presented in different ways and that learning, therefore, actually has more to do with presenting the information in its best modality (Stahl, 1999; Willingham, 2005) than trying to format everything to match some overall, superior modality. Hands-on learners may have significantly outperformed traditional learners in previous hands-on research, not because the hands-on method was better overall as a learning style, but because the curriculum they taught was best learned in a hands-on way. In contrast, the three Language Arts lessons used in our study may not be best learned using the hands-on approach.

Although the purpose of using an authentic assessment was to see if it captured knowledge obtained through hands-on learning that standardized assessments failed to capture, our results do not reflect this thought. It is possible that hands-on learners did not significantly outperform traditional learners on the authentic assessments for two reasons. First, authentic assessments may in fact capture knowledge obtained through hands-on learning; however, in order for there to be knowledge to capture, hands-on learning must be an effective learning strategy. As explained above, hands-on learning may not have yielded significantly higher results on either the standardized or authentic assessments because the length of exposure to hands-on learning was too short or because the hands-on method was not ideal for the Language Arts curriculum used. Second, it is also possible that authentic assessments simply do not capture the specific knowledge obtained through hands-on learning. More research needs to be done, testing the hands-on learning method with authentic assessments.

Limitations

The biggest limitation in our study was the amount of time we waited between teaching the lessons and giving the assessments. Although one week fit within the suggested time-frame for short-term retention, assessing the participants a full week after they were presented with a 20-minute lesson was too long of a period of time for third-graders, especially because they were only exposed to the lesson material for the 20 minutes and then did not practice it or see it until the assessment one week later. This need to assess the participants closer to the time they were exposed does not mean that hands-on learning is ineffective over a longer period of time

or that its effects wear off after only a day. Rather, because there was a short period of exposure time followed by the long period of no exposure, neither the traditional nor the hands-on group retained information very well, with more participants receiving failing grades than we feel is usual in a typical third-grade class. Another limitation of our study is that we did not use random assignment to divide participants into traditional and hands-on groups but rather assigned them based on their homeroom classes. Even though random assignment may have elicited more accurate results, it was not a feasible option for us, since we were conducting our study in the school setting during the normal school day. Although the homeroom classes were not organized by intelligence or ability level, we felt that one class in particular showed a higher level of ability than others. The lack of random assignment left open the possibility that pre-existing group-level differences between the classes (e.g., ability level) may have masked any differences in performance between the traditional and hands-on groups. Another minor limitation in our study was that we did not explain the satisfaction questionnaires very thoroughly to the participants. After the first week, we learned that we had to explain each of the five ratings on the satisfaction questionnaire rather than assuming that we could just explain number one (“did not enjoy the lesson at all”) and number five (“enjoyed the lesson a lot”) and count on the third-graders to understand the progression of numbers two, three, and four in between. That lack of clarity, combined with the fact that we were new teachers and were therefore automatically more exciting to the students in the beginning, gave us some skewed satisfaction ratings during the first week. Lastly, another limitation was that we really did not know adverbs well enough to teach them. We tried to stick with the basics, but during the lesson we were sometimes unsure of how to respond to participants’ particular

questions or comments about adverbs. Having a better grasp on the material we were teaching probably would have made us more confident and thorough in our teaching, which in turn probably would have given participants a clearer understanding of what they were learning and thus affected their performance.

Future research

In addition to keeping the above limitations in mind, other suggestions could also prove useful. First, a longer study—perhaps a school year, reflecting the studies by Saunders and Shepardson (1987) and Ward, Sadler, and Shapiro (2008)—would not only allow participants to get used to the instructor, thus eliciting more reliable scores on the satisfaction questionnaires, but it would also allow participants to get used to the hands-on style of learning. Also, prior to running the study, it might be beneficial to find out participants' preferred learning style (e.g., kinesthetic or hands-on, visual, auditory, etc.). Even though, as previously mentioned, some research suggests that presenting information to match the students' preferred learning styles is not as important as presenting the information in its best modality (Stahl, 1999; Willingham, 2005), other research still supports the belief that preferred learning styles are an important factor (Smith & Renzulli, 1984; Dunn et al., 2009; Tzu-Chien & Graf, 2009). By testing for preferred learning style, future researchers will be able to see if the hands-on method is only beneficial for those participants who prefer that learning style or if the preferred learning style does not matter.

Implications

The purpose of this study was to see if hands-on learning is more beneficial than a more traditional approach. The results indicate that hands-on learning, when applied to Language Arts, does not lead to significantly greater retention in students than a more traditional approach, at least in the short-term. However, the traditional group did not significantly outperform the hands-on group either, indicating that the hands-on method does not hinder learning, and, in one out of three cases, students will enjoy the lesson significantly more. This information may be particularly helpful to teachers, especially third grade Language Arts teachers who are interested in making learning fun and enjoyable for their students.

It is also important for teachers to remember that student achievement is affected by many other factors outside of teaching style. Although the method of teaching may make a difference, especially with longer exposure to the method and with an appropriate curriculum, numerous other factors such as teacher ability, student intelligence, home life, and so on can also affect how well a child performs in school (Bartz & Miller, 1991; Williams, 1998). Given the variety of variables that affect school performance, it is not all that surprising that any effect of a short-term intervention like this study is small.

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STANDARDIZED ASSESSMENT—IDIOMS

Directions: Circle the best answer.

1. What is the literal meaning of “Cat got your tongue?”
 - a. A cat is biting your tongue.
 - b. You are being really quiet.
2. What is the figurative meaning of “It is raining cats and dogs?”
 - a. Cats and dogs are falling from the sky like rain.
 - b. It is raining really hard.
3. What is the figurative meaning of “Are you pulling my leg?”
 - a. Are you grabbing my leg and pulling on it?
 - b. Are you joking?
4. What is the literal meaning of “It was a piece of cake?”
 - a. It was a piece of cake that you could actually eat.
 - b. It was really easy.

Directions: Underline the idiom in the sentence.

1. Stop copying my answer, you copycat!
2. They were back to square one after their first idea did not work.
3. The girl came clean after her mom caught her lying.
4. The basketball team made sure that they always played fair and square.
5. The thief was caught red-handed.

Appendix B

STANDARDIZED ASSESSMENT—ADJECTIVES

Directions: Choose the adjective in each sentence.

1. The orange cat ran down the stairs and out the door.
 - a. cat
 - b. orange
 - c. stairs
 - d. ran

2. Lucy slowly ate the tasty sandwich that her mom made for her.
 - a. ate
 - b. slowly
 - c. tasty
 - d. mom

3. The girl looked very pretty in her dress while she spun around in circles.
 - a. very
 - b. dress
 - c. spun
 - d. pretty

4. The giraffe had a long neck that it used to eat the leaves on the top of the tree.

- a. giraffe
 - b. long
 - c. leaves
 - d. eat
5. The cold water quenched his thirst after his run.
- a. cold
 - b. thirst
 - c. after
 - d. run

Directions: Circle the adjective, and underline the word it describes.

- 1. Ten puppies are playing in the grass.
- 2. Where is the smallest pan?
- 3. Sam has a racing bicycle.
- 4. The black kitten was playing with a ball of yarn.
- 5. Do you know the man in the leather jacket?

Appendix C

STANDARDIZED ASSESSMENT—ADVERBS

Directions: Choose the adverb in each sentence.

- 1. The child quickly ate her dinner so she could have dessert.
 - a. dinner
 - b. quickly
 - c. her
 - d. dessert
- 2. I went to my friend's birthday party yesterday.
 - a. friend's
 - b. party
 - c. birthday
 - d. yesterday
- 3. The grandparents were very happy to see their grandchildren.
 - a. their

- b. happy
 - c. very
 - d. grandchildren
4. After a long drive, we gladly got out of the car and stretched our legs.
 - a. long
 - b. gladly
 - c. stretched
 - d. car
 5. The red balloon floated higher into the air than the green balloon.
 - a. higher
 - b. green
 - c. air
 - d. floated

Directions: Circle the adverb in each sentence and underline the word it describes.

1. We arrived late to the movie and missed the beginning.
2. The soldiers bravely fought in the war.
3. I usually bring my lunch with me to school.
4. The athlete is thirsty and needs a drink of water now.
5. The stars shine brightly in the night sky.

Appendix D

AUTHENTIC ASSESSMENT—IDIOMS

Directions: Read the paragraph, and underline the idioms. Write the figurative meaning of the idiom above it.

Even though I was sitting in the back of the bus, all eyes were on me.

“You are really skating on thin ice, Smith,” Andrew said.

“What do you mean?” I asked him. “Why are you so mad?” Andrew was my best friend, but he seemed really upset with me.

“You know what you did,” he said as the bus pulled up to his stop. “I told you that I liked Sara, and you just let the cat out of the bag. Now everyone knows! You are the worst friend I have ever had!” Before I could explain what had happened, he got off the bus. As soon as I got home, I called Andrew and told him that Sara had come up to me and asked me if he liked her because she liked him. When I told her that he did, she told her best friend Amber who spread the news, not me. With the knowledge that Sara liked him too, the ice was broken, and Andrew went up and talked to Sara the very next day.

Appendix E

AUTHENTIC ASSESSMENT—ADJECTIVES

Directions: Write a paragraph describing a Christmas tree. Underline the adjectives. (minimum of 3 sentences)

Appendix F

AUTHENTIC ASSESSMENT—ADVERBS

Directions: Watch the video clips and describe what happens. Underline the adverbs.

- I. High jumping cat—youtube.com/watch?v=6Tvs7heiUA8—A cat jumps from a table to the top of a shelf.
- II. Adrian blasts a big triple—youtube.com/watch?v=ojYgawukVQs—Adrian, a baseball player, hits the ball hard into center field, runs quickly around the bases, and slides safely into third.
- III. Kids swinging 2—youtube.com/watch?v=ikW1jOmD5ol—Two children are swinging on a swingset, and the older child swings higher than the younger child.

Appendix G

SATISFACTION QUESTIONNAIRE

How much did you like the lesson?

(not at all) 1

2

3

4

5 (a lot)

Appendix H
DEMOGRAPHICS

Age:

Sex:

Ethnicity:

Appendix I

PARENTAL CONSENT FORM

Dear Parent or Guardian,

We are two senior psychology majors from Hanover College. For our senior thesis paper, we are interested in how different levels of activity implemented into the lessons can help the students better learn and remember what they are taught. To do this, we will be teaching one Language Arts lesson a week for three weeks. After the lesson is taught, the students will be asked to fill out a satisfaction questionnaire, answering how much they liked the lesson. One week after each lesson is taught, the students will take tests over what they have been taught. Five weeks after the final lesson is taught, the students will take a final test* over what they have been taught.

There are no known risks of being involved in this study. There may be some benefit, though; your child may learn valuable information from the third-grade curriculum.

Your child is free to quit any time without penalty. All information obtained will be anonymous, and your child's name will not be used when discussing this study, and all information about your child will be destroyed at the completion of the project.

We would like to include your son or daughter in our study, but we need your consent because he or she is a minor. If you **DO NOT** want your child to participate in this study, please sign and date this form and send it back in before FRIDAY, JANUARY 14, 2011.

If you have any questions or comments about this study, please feel free to contact Ellen Altermatt at altermatte@hanover.edu.

I **DO NOT** want my child participating in this study.

Signature

Date

*A final test was not given five weeks after the final lesson due to a lack of significant results for the first hypothesis, which the significance of the second hypothesis depended on.

Appendix J

Effect of Hands-on Learning on Short-Term Retention in Third-Grade Students

ASSENT FORM

Our names are Ivy Ivers and Whitney Helton. We are trying to learn about how doing different activities in the classroom can help you learn better and remember what you learned better. If you would like, you can be in our study.

If you decide you want to be in our study, you will fill out a questionnaire telling us your age, gender, and ethnicity. Then you will participate in three classes taught by one of us and take tests over what you learned in our classes and tell us if you liked our classes.

There are no known risks with this study, but you might learn something that you did not know before.

Other people will not know if you are in our study. We will put things we learn about you together with things we learn about other children, so no one can tell what things came from you. When we tell other people about our research, we will not use your name, so no one can tell who we are talking about.

Your parent or guardian has to say it's OK for you to be in the study. After they decide, you get to choose if you want to do it too. If you don't want to be in the study, no one will be mad at you. If you want to be in the study now and change your mind later, that's OK. You can stop at any time. We will give you a copy of this form in case you want to ask questions later.

I have decided to be in the study even though I know that I don't have to do it. Ivy and Whitney have answered all of my questions.

_____	_____
Signature of Study Participant	Date
_____	_____
Signature of Researcher	Date

Appendix K

DEBRIEFING FORM

The study in which you just participated was designed to see how hands-on learning effects how well you learn and remember what was taught. There were two groups—a hands-on group who did a lot of hands-on activities during the lessons and a traditional group who did not do any hands-on activities during the lessons. After each lesson, you were asked how much you liked the lesson. You were also tested over each lesson one week after the lesson.

If you or your parent/guardian have any questions or comments about this study, please have your parent/guardian contact Ellen Altermatt at altermatte@hanover.edu.

Table 1

Mean Scores and Standard Deviation of Traditional and Hands-on Participants on Standardized Assessments

Lesson	Standardized Assessment			
	Mean		Standard Deviation	
	Traditional	Hands-on	Traditional	Hands-on
Idiom	0.74	0.62	0.26	0.29
Adjective	0.66	0.63	0.376	0.31
Adverb	0.52	0.63	0.33	0.85

Table 2

Mean Scores and Standard Deviation of Traditional and Hands-on Participants on Authentic Assessments

Lesson	Authentic Assessment			
	Mean		Standard Deviation	
	Traditional	Hands-on	Traditional	Hands-on
Idiom 1	0.76	0.84	0.37	0.23
Idiom 2	0.78	0.87	0.35	0.22
Adjective 1	0.56	0.52	0.43	0.4
Adjective 2	0.14	0.14	0.11	0.13
Adverb 1	0.4	0.27	0.42	0.35

Adverb 2	0.14	0.09	0.1	0.07
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Table 3

Mean Scores and Standard Deviation of Traditional and Hands-on Participants on Satisfaction Questionnaires

Lesson	Satisfaction Questionnaire			
	Mean		Standard Deviation	
	Traditional	Hands-on	Traditional	Hands-on
Idiom	4.88	4.64	0.42	0.96
Adjective	3.67	4.58	0.71	0.87
Adverb	4.00	4.56	1.00	0.86

Figure Captions

Figure 1. Mean scores (+ SE) for traditional and hands-on groups on the idiom, adjective, and adverb standardized assessment.

Figure 2. Mean scores (+ SE) for traditional and hands-on groups on the idiom 1, adjective 1, and adverb 1 authentic assessment.

Figure 3. Mean scores (+ SE) for traditional and hands-on groups on the idiom 2, adjective 2, and adverb 2 authentic assessment.

Figure 4. Mean scores (+ SE) for traditional and hands-on groups on the idiom, adjective, and adverb lesson satisfaction questionnaires.

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