Interactive Science Notebooks: Do Strategies Make a Difference?

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Foundations of Research in Education

EDFR 6300

December 7, 2013

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Abstract

The science department in Arlington Independent School District requires that all science teachers implement the use of interactive notebooks into their curriculum, but do all teachers understand the benefits of the notebook? Are there interactive notebook strategies that allow students to reap the full benefits of the notebook? The purpose of this research study is to determine if interactive notebooks assist with information processing and to respond to the question of whether or not interactive notebook strategies affect student achievement in science. The science department will be the only one involved in the research study at the junior high school campus. Every 7th and 8th grade science teacher and their students will participate in this study.

Keywords: Interactive notebook, strategies, junior high school, science

Interactive Science Notebooks: Do Strategies Make a Difference?

For centuries, scientists such as Benjamin Franklin and Thomas Edison have kept their most precious experiment and observation notes in a personal notebook. Science students across the United States are asked to imitate these great scientists' documentation approaches with the implementation of an interactive science notebook. The science department in Arlington Independent School District requires that all science teachers implement the use of interactive notebooks into their curriculum, but do all teachers understand the benefits of the notebook? Are there interactive notebook strategies that allow students to reap the full benefits of the notebook?

Statement of Research Problem

Interactive notebooks are being used by teachers who cannot infer that interactive notebooking benefits student achievement. Arlington Independent School District has new and experienced science teachers who are uneducated in discerning ineffective interactive notebooking strategies from effective interactive notebooking strategies. These unknowledgeable teachers are located on all three campus levels, elementary, junior high and high schools. In their *Integrating Interactive Notebooks* article, authors Waldman and Crippen (2009) declared that "at its best, an interactive notebook provides a varied set of strategies to create a personal, organized, and documented learning record" (p. 51). Their statement implies that interactive notebooks at its worst can be incorrectly and inefficiently implemented. Interactive notebooks can be a "powerful instructional tool" (Waldman & Crippen, 2009, p. 51), or it can be insignificant instructional tool.

A secondary issue to arise in this research study is the lack of student personalization in the interactive notebooks. Students should be a part of deciding the type of information that is

included their notebooks. According to Young (2003), there are two types of pages in the notebooks, a left-side page and a right-side page. The right side represents ideas and content information from the teacher. The left side of the notebook is where students can personalize their understanding of information received from the instructor on the right side. The left side can still be guided by the teacher, "to help focus [the student's] attention" (Young, 2003, p. 45), but the student will show their own interpretation of the content. Teachers who are unaware of the interactive notebook's function tend to fill student`s notebooks with the teacher's interpretation of content leaving the student without a voice in their own notebook. The notebook should become a place where students are free to display and express their perception of information (Klentschy, 2010). In Figure 1, Chesbro (2006) provides an example of a student expressing their interpretation of the development of the atomic theory, on the left side, based upon notes supplied by the instructor on the right side.

Interactive notebooks can have various structural styles and it's challenging to construct a style that allows students to take ownership of their learning. Figure 2 shows how authors Waldman and Crippen prefer to structure their interactive active notebooks using *in, though,* and *out* activities (2009). The left page of the journals hosts the "*in* and *out* activities [that] [prompt] student responses," while the right page presents "*through* activities [that] are provided by the teacher" (Waldman & Crippen, 2009, p. 52). With this in mind, the purpose of this research study is to determine if interactive notebooks assist with information processing and to respond to the question of whether or not interactive notebook strategies affect student achievement in science.

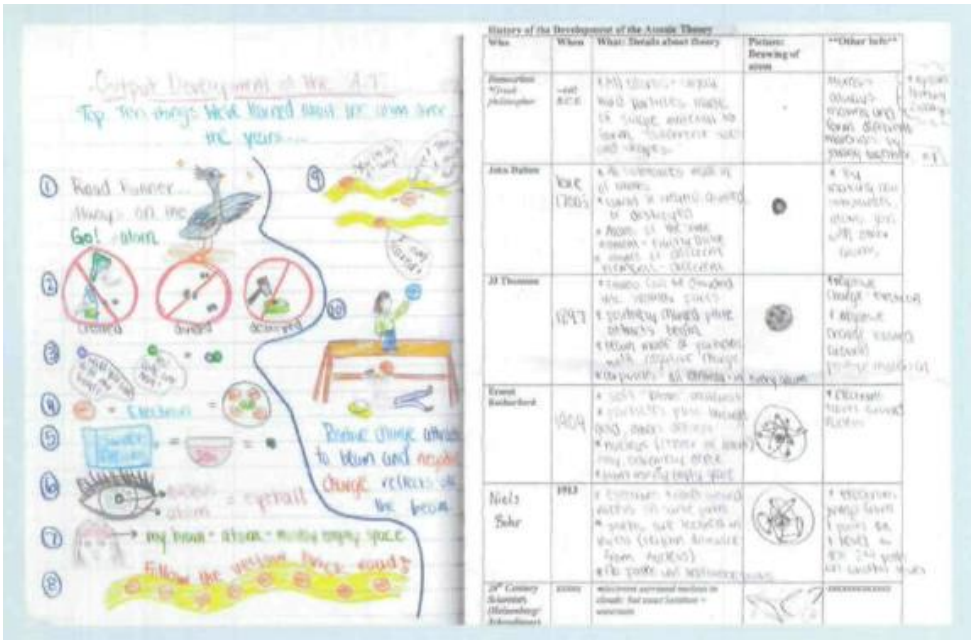

Figure 1. Student interpretation of the atomic theory development. The left page is guided by the right page.

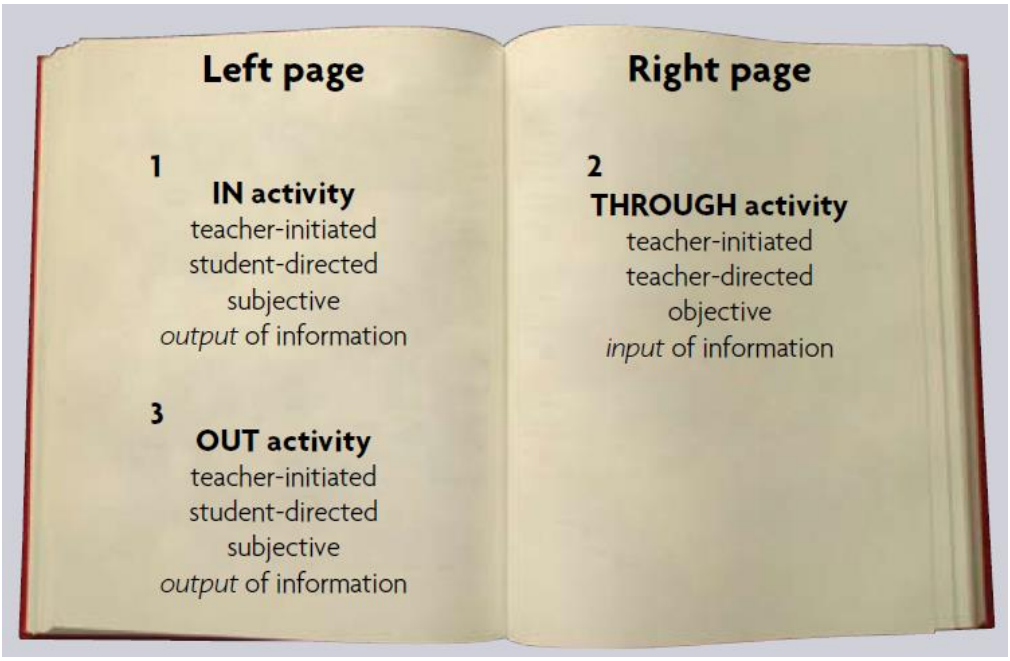

Figure 2. Interactive notebook left and right page sample. Teacher provided information is located on the right page and student responses are located on the left page.

Objectives

Main objective. The main objective of this study is to determine if interactive notebook strategies affect student achievement in science.

Secondary objectives. Upon completion of this research study it will be determined if interactive notebooks assist with information processing, it will establish if the teacher must implement specific strategies for interactive notebooking to be beneficial, and ineffective and effective strategies for notebooking will be compared.

Justification

Since Arlington Independent School District's science department mandated that every science teacher implement an interactive notebook, a study will be conducted on the effectiveness of this instructional strategy. It is essential for every science teacher in the district to understand the benefits of using efficient notebooking strategies. The first year I taught junior high school science, I was told that I had to use an interactive notebook. Even though I was not given a compelling reason as to why I had to use the interactive notebook, I complied with the district requirement. I asked a few of the experienced science colleagues how to setup and use the notebook and they all had different interpretations. During the second week of school, I was informed that it was time to set up the notebooks and I was still confused on what needed to be included in the notebooks and why. I am currently in my second year of teaching and still have not fully grasped the importance of the interactive notebook or the use of effective interactive notebooking strategies.

The district lacks professional development for interactive notebooks. This study is important to me because there is more first year and experienced science teachers that have not identified the value of the mandatory notebook. When teachers do not inform students about the

significance of the interactive notebook, the students will not take ownership of, or express interest in, their interactive notebooks. The results of this study may be used by the science department heads on every campus to hold teachers accountable for using effective strategies. The school district may also use the results to organize a professional development session for teachers who express interest in learning about interactive notebooks. The school district might also organize a mandatory professional development session for all science teachers.

Limitations of the study

This study will be delimited to one junior high school campus in the Arlington Independent School District. The science department will be the only one involved in the research study at the junior high school campus. Every 7th and 8th grade science teacher and their students will participate in this study. The teacher's prior knowledge of interactive notebooks could become an obstacle for the investigation.

Definition of terms

For the purpose of this study, the below list of terms are defined as follows:

Formal assessment: "a systematic way to evaluate how well students are progressing" (What are the, para. 2). Examples: chapter tests, district curriculum assessments, state testing.

In activities: Located on the left side; Reexamines prior topics, initiates new topics, explores prior intelligence and is student directed (Waldman & Crippen, 2009).

Informal assessment: "group or individual projects, experiments, oral presentations, demonstrations, or performances" (What are the, para. 5).

Interactive notebook: "Daily journal-type recording of student-written class notes from reading, lecture, and discussions, and the reflective and metacognitive responses students make to their own note taking" (Carter, Hernandez & Richison, 2009, p. 3).

Left side: Output; "process [the] input into meaningful and personalized manner" (Chesbro, 2006, p.31). Examples: drawings, summaries, graphic organizers.

Out activities: Located on the left side; Wraps up the lesson at the end of class with a review on the topic and is student directed (Waldman & Crippen, 2009, p. 52).

Right and left hemispheres: " help you to sort, categorize, remember, and creatively interact with the new knowledge you are gaining" (Young, 2003, p. 65).

Right side: Input; Teacher driven information such as "lecture notes, lab data, reading notes, etc" (Chesbro, 2006, p.31).

Scaffolds: "supports for understanding the process of" (Klentschy, 2010, p. 8).

Spiral notebook: 70 to 100 lined pages.

Through activities: Located on the right side; Includes everyday tasks and instructions and is teacher directed (Waldman & Crippen, 2009).

Visuals: "graphs, charts, tables, and diagrams" (Gilbert & Kotelman, 2005, p. 30).

Literature Review

Administrators and educators throughout the country are looking for ways the improve student learning and academic achievement. Potential improvement plans for some schools and school districts may come in the form of educational software, textbooks, or technological devices. For many schools across the country, the campus improvement plan involves the implementation of interactive student notebooks. Interactive student notebooks can be applied to all content areas, but it has been notoriously used in science departments.

Numerous articles featuring interactive notebooks as an instructional strategy were reviewed to reveal the major concepts and relationships associated with notebooking in education. Science notebooks have been used in an assortment of educational institutional levels ranging from elementary school to middle school to high school and even college. The reviewed articles addressed several aspects of interactive science notebooks such as the type of entries, notebook set up, benefits of the notebook, note-taking strategies used with interactive notebooks, the use of lecture notebooks, writing in the notebook, and the relationship between notebooking and achievement. Even though many schools and educators have implemented the use of interactive notebooks in the classroom, there are limited research studies available for review.

What is an Interactive Notebook?

An interactive notebook can be used as an instructional strategy for teachers and a resource tool for students. According to Young (2003), the interactive notebook is a "tool used to strengthen learning of curriculum (input) through increased student participation (the output)" (p. 44). These notebooks are also meant to be a place where students can ponder on their ideas and "construct his or her own conceptual understandings" (Gilbert & Kotelman, 2005, p. 29) of the

content discussed in class. From a science perspective, students are expected to understand and apply the scientific investigation process, as well as interpret their investigation findings. When educators accept the challenge to implement student notebooks as an instructional strategy, there are two potential outcomes for the notebook. Simply having student record information and finishing an assignment in their notebook is an ineffective use notebooking. On the other hand, requiring students to expound on information and assignments in a personalized way to show their understanding of content is an effective use of notebooking. Klentschy (2010) states that:

> Science notebooks have the potential to move students beyond completing the task to making sense of the task, transitioning from writing about what they did during a science investigation to writing about what they learned from the science investigation. In this way, science notebooks support the development of students' scientific reasoning. (p. 8)

Interactive Science Notebooks Benefits

When interactive science notebooks are applied correctly in the classroom, it benefits the student and teacher. Students are encouraged to explain and elaborate on content "in a meaningful and personal manner" (Chesbro, 2006, p. 31). As students personalize their notebook entries, it provides a gateway to the student thinking, which in turn provides the teacher with feedback on the area of content students does and does not understand (Gilbert & Kotelman, 2005). Student development of writing skills and differential learning are two additional notebooking benefits for teachers. Writing in the notebook will become an everyday task. As students are exposed to a variety of writing styles they will become accustom to writing. Every student is not on the same learning level and some students will struggle with the written portion of the notebook. The notebook permits teachers to accommodate those varying learning levels by

allowing students to use graphics and charts as an alternative assessment of understanding (Gilbert & Kotelmen 2005).

Notebook Setup: Structure and Content

Notebook Type. Interactive student notebooks are setup based upon the preference of the teacher. Depending on the teacher, there are potentially three different types of notebooks students can use in class. Some teachers prefer to have their student use a spiral notebook. It has been suggested that students use spirals notebooks with "hard or plastic covers [because] they seem to be the most durable and can last for at least one semester" (Young, 2003, p. 44). Chesbro (2006) also chooses a specific type of notebook for student use, a composition book, for durability as opposed to using spiral notebooks. One author prefers to use a three ring binder instead of a spiral notebook and composition book because binders allow for greater "flexibility" (Joyner, 2010). Joyner (2010) despises that traditional fold, cut, and paste method of inserting material into the notebook and rather use three ring binders "because students can add and move both teacher-created materials and workbook pages as needed… and rearrange pages when necessary" (p. 29).

Organization. Interactive notebooks can be viewed as an organizational tool for students as well as a resource and personal reflection of their understanding of materials. In order for the notebook to be used as a resource, it must include a few standard organizational features like any other book. It is suggested that every student's notebook be identical in layout and structure. A standard book includes a table of contents to help the reader locate specific sections of the book. Joyner (2010) suggests that all interactive notebooks include a table of contents to stress the "organizational components" (p. 31) of the notebook. A standard book also includes page

numbers for sequencing. In order for students to refer back to an entry and concept that was previously covered, it must be easy for them to locate it. Having every student number their notebook pages will assist in student awareness of locating information and viewing the notebook as a valuable resource (Waldman & Crippen, 2009). One author mandates that every student notebook entry page include a date and title associated with the task or notes contained on that specific page (Chesbro, 2006). Every educational reference book includes a glossary of key terms and their definitions. Joyner (2010) prefers that interactive notebooks include a glossary because "it's essential for students to record science vocabulary as it is uncovered in lessons and refer back to the words in an organized manner" (p. 31).

Content. Students are not only required to have a specific type of notebook that is organized like a standard book, but the content of the notebook must have a specific layout to help maximize the efficiency of the notebook. The majority of the articles reviewed implemented the left–side right-side notebooking layout. The articles that did not use the left–side right-side layout did not specify the layout of their notebook contents. The right-side of the notebook is designated for information and materials provided to the student by the teacher, which is termed *input*. The left-side of the notebook provides an allotted area for students to demonstrate how they have processed the information that was provided by the teacher on the right-side of the notebook, which is termed *output* (Young, 2003). The left-side right-side notebooking techniques was also implemented by authors Leffler and Crauder (2011), who assigned the right page for "content items…and thought-based experiences on the left page" (p. 57).

Authors Waldman and Crippen (2009), integrates a variation of the left–side right-side notebooking layout that includes "*in, through,* and *out* activities [in order to] provide a daily rhythm of learning" (p.52). The left page of their variation still includes output from the student

and input from the teacher on the right page. The left page is divided into two halves. The top half of the left page is reserved for *in* activities that are completed by the student at the start of class. *In* activities displays students personalized understanding of previously learned concepts. The bottom half of the left page is reserved for *out* activities that are completed by students are the end of class. *Out* activities provide closure to the daily lesson as students reexamine and connect ideas about the current concept (Waldman & Crippen, 2009). Examples of *in*, *out*, and *through* activities are listed in Figure 1, which lists left side and right side activities that can be incorporated into any interactive notebook even if teachers are not implementing the *in*, *out*, and *through* activities notebooking technique. Many of the left and right side strategies provided in Figure 1 were given as examples in other reviewed articles.

Left side	**Right side**
Examples of student-directed *in* and *out* activities:	Examples of teacher-directed *through* activities:
• A drawing, photo, or magazine picture that illustrates a new concept or idea • Questions, opinions, and personal reflections about the new information • Predictions, contradictions, or quotations relating to the *through* activity • Practice problems or inquiry activities • Metaphors, analogies, acronyms, poems, songs, or cartoons that capture the new information or issue • Connections between the information, and the student's life, another course, or the world • Reflections on and summary of activities	• Lecture, discussion, or reading notes • Laboratory procedure or rough draft • Film, video, and documentary facts or notes • Small- or large-group discussion notes • Collaborative group process summary • Excerpts of a news or journal article • Vocabulary exercises • Worksheets and activities

Figure 3. Interactive notebook activities. The left side activities are for student output and the right side activities are for teacher input.

Note Taking Strategies

Taking notes is an inevitable task that students will eventually participate in at some point throughout their use of the interactive notebooks. There are strategies that teachers can instruct

students to use that will assist in effectively taking notes. The use of coloring, highlighting underlining and circling have been noted as useful strategies to apply when taking notes. One article proposes that students underline, circle, and color code notes and illustrations as a focus technique to draw students towards the most important information (Stencel, 2001). Stencel (1998) provides his collegiate biology and anatomy and physiology students with interactive lecture notebooks in which he specifically advises students to "[underline] main ideas, [circle] new terms or keywords, [draw] arrows to connect ideas, and use [stars] to indicate important ideas" (p. 344).

Identifying new terms, keywords, and main topics within content notes can be accomplished using another note taking strategy called Cornell notes. Cornell notes have been identified as the primary note taking strategy employed in two reviewed studies. Both studies investigated the effectiveness of interactive notebooks on student achievement and Cornell notes was an input activity for students to partake in on the right side of their notebook (Green, 2010; Wilkins, 2009). Donohoo (2010) depicts the use of Cornell notes as an effective note taking strategy when a high school science teacher decides to enforce Cornell notes as her primary note taking tool during the second half of the school year. Students were provided a Cornell note template and were initially guided step by step through the Cornell process by their instructor, using daily lecture notes. Over time, the instructor gradually discontinued note taking guidance and students were responsible for taking notes independently using the Cornell notes process. Class averages and midterm exams we analyzed to determine if Cornell notes was truly an effective note taking method. In comparison to teachers that did not use Cornell notes, the instructor who did use Cornell notes had a 30% higher passing rate on the midterm and a 10-12% increase in her course averages than the preceding year. It is suggested that Cornell notes are

effective because it allows teachers to coach students on "how to summarize and take notes …identify keywords, condense important information into their own words, and solidify meaning" (Donohoo, 2010, p. 227).

Research Studies

Interactive notebooks effect on processing skills. Science is an inquiry based discipline that heavily relies on processing skills. Interactive notebooks were tested for their effectiveness to improve the processing skills of students in two different studies. The first study, conducted by Cumbo (2011), examined student's ability to "make predictions, formulate connections, and explain scientific reasoning" (p. 17) after the implementation of interactive science notebooks. There were a total of four medium to low ability leveled eighth graders participating in this study. At the start of the school year, the participants were in a traditional science teaching classroom and then the teacher switched her primary instructional strategy method to incorporate interactive student notebooks. The researcher/ teacher gathered data from rubrics assessing student lab conclusions, pre- and post- attitudinal survey over the everyday application of science notebooks in class, questions regarding the advantages of using science notebook answered by the four participants in a focus group, and a field journal compiled with daily observations of student interaction with the notebook. After six weeks of collecting data, it was determined the results from the lab assessment rubrics indicated there was no progress shown in the students' problem solving abilities and application of critical thinking skills (Cumbo, 2011). There were improvements made in the students' ability to give more detail answers to questions posed in class. This qualitative and quantitative research study was only conducted for six weeks and should be replicated for a longer period of time and a larger sample of participants.

The second study conducted by Mallozzi and Heilbronner (2013) questioned the influence interactive notebooks would have on student processing skills if metacognitive strategies were constantly practiced throughout the notebook. The results of the study determined that using interactive notebooking in combination with metacognitive strategies improved student's processing skills (without written teacher feedback) in comparison to instructional strategies in a traditional science classroom. Their study also concluded that student's processing skills were not affected by written feedback from the teacher.

Interactive Notebooks effect on Academic Achievement. Academic achievement is a main concern for schools and teachers. There were three studies conducted in middle school and high schools that examined the effect interactive notebooks have on student academic achievement in math and science. The first study with a "quasi-experimental research design of nonequivalent control group" (p. 37), was conducted by Green (2010) in a middle school with grades ranging from fifth to eighth grades. Green's study focused on two fifth grade classes, in which each teacher taught the same group of students for science and math. The control group contained a teacher with traditional note taking instructional strategies. The experimental group contained a teacher that incorporated non–traditional Cornell notes while using the left-side right-side techniques in an interactive student notebook. Student participants were given a pre- and post- test textbook assessment over the units students were studying in class. The results of the unit pretest and posttest indicated that there was no statistical significance in achievement when interactive notebooks were used as a primary instructional tool. Although there was no significant improvement in student achievement in math and science, the study did revealed a two to five point increase in test scores averages from students using the interactive notebooks.

The second study conducted by Wilkins (2009) examined if interactive notebooks will improve student achievement. The research study takes place in a middle school and includes nineteen eighth graders in a TAKS science class. The instructor in the class integrated the use of interactive notebooks as the primary instructional tool along with revised Cornell notes, the left-side right-side notebooking techniques and exposure to expository writing. The study was conducted throughout the school year and student achievement was measured using two district assessments and the state mandated TAKS test. District assessment average scores of students using interactive notebooks as a primary instructional source were compared to the average scores of students that were not using interactive notebooks. Results from the two district assessments indicated the use of interactive notebooks increased student average scores and not using an interactive notebook decreased student average scores. Results from the TAKS science test reveal the gap, between the district's student average score and the participants' student average score, decreased from fifth to eighth grade after an entire school year of using interactive notebooks.

In the third and last study, Kellogg (2012) investigates the influence science notebooks have on student achievement and attitude through a blended traditional and nontraditional inquiry-based form of notebooking. The results of the study indicated that blended forms of traditional and nontraditional inquiry-based notebooking increased student achievement.

Conclusion

Interactive student notebooks can be applied to all content areas, but it has been notoriously used in science departments. Teachers gain access to their student's personal interpretation of content when interactive notebooking is integrated correctly. The success or

failure of the notebook can be reflected in the initial structural set up and organization of the notebook. Integrating the left-side right-side notebooking technique permits students to perform at higher conceptual levels. Exposing students to note taking strategies such as circling, underlining, color coding, and Cornell notes will help students pinpoint main ideas, keywords, and summarize content. The effectiveness of interactive notebooks on student achievement and scientific processing skills were examined through five research studies with varying qualitative and quantitative methodologies. In three out of five studies, interactive notebooks exhibited a positive influence of student achievement and processing skills.

After examining the different studies on interactive notebooks, a combination of qualitative and quantitative methodologies will be incorporated in this research study. An experimental study will be conducted with a control group (no interactive notebook usage) and an experimental group (interactive notebook usage). A focus group of participants will be formed to gather student's perspective on the interactive notebooking strategies that are being implemented. Student achievement will be measured using two district curriculum assessments that are administered at the end of each semester.

Methodology

The popularity of interactive notebooks is a growing trend amongst educational institutions. Science is one subject area that has embraced the use on interactive notebooks. Teachers in one school district are required to integrate its use into their daily lessons. The purpose of this research study is to determine if interactive notebooks assist with information processing. The methodology of this research will address the research method and design appropriateness, driving research questions, and the population and sample. In addition, data collection, instrumentations, validity, reliability and data analysis will be disclosed.

Research Method and Design Appropriateness

This research study is founded upon an action research design. Action research can examine several aspects of education such as how schools function, how teachers instruct their students and how students acquire academic knowledge (Gay and Mills et al., 2012). The intention of conducting action research is to solve "everyday problems in schools so that they may improve both student learning and teacher effectiveness" (Gay and Mills et al., 2012, p. 508). Teachers are exposed to various instructional strategies through professional development and are encouraged to implement those strategies in their classroom. Due to time constraints in the classroom, teachers are interested in knowing if certain instructional strategies are effective and improving student learning. Since action research is "done by teachers, for themselves" (Gay and Mills et al., 2012, p.508), it also allows teachers to directly investigate an area of concern and interest that will enhance their professional practice and desired student outcomes.

In order to properly explore the effectiveness of interactive notebooks, a mixture of qualitative and quantitative methods will be used in this research study. A mixed method

research study permits the researcher to "build on the synergy and strength that exists between quantitative and qualitative research methods to understand a phenomenon more fully than is possible using either quantitative or qualitative methods alone" (Gay and Mills et al., 2012, p.483). Typically in an educational setting, the effectiveness of instructional strategies on student achievement is measured by how well students perform on formative and summative assessments, therefore quantitative research methods will be applied. Qualitative research methods will be applied to this study to gain a student's perspective of how effective interactive notebooks are on student achievement outside of formal assessments.

A quasi-experimental design will be incorporated to examine differences in student achievement when interactive notebook strategies are and are not consistently implemented as an instructional strategy. A quasi-experimental design is imposed when participants in a study are unable to be randomly selected individually (Gay and Mills et al., 2012). In an educational setting, the ability to randomly assign individual students to control and experimental groups is challenging given the fact that the students randomly chosen may not be students of the researcher. The non-equivalent control group aspect of the quasi-experiential design will most benefit the researcher as intact groups, or classes, are randomly chosen to participate in the study instead of a random selection of individual students.

The independent variable in this study is the type of note-taking strategies implemented by teachers, traditional note-taking strategies or non-traditional interactive notebooking strategies. The dependent variable is students' achievement according to pre- and posttest scores.

Research Questions

This research study will address the following questions:

1. Do interactive notebook strategies affect student achievement in science?
2. Are there interactive notebook strategies that allow students to reap the full benefits of the notebook?
3. Do interactive notebooks assist with information processing?

Population

This study will take place in a junior high school located in a large school district in north Texas. The junior high school contains grades seven and eight with a total population of 811 students. The student demographics of the school include: 1% (8) two or more race, 8% (64) Asian, 14% (114) Black, 16% (130) Hispanic, and 61% (495) White. The school's student sub-groups encompass 1% (8) having Limited English Proficiency (LEP), 13% (105) in special education, 19% (154) being economically disadvantaged, and 37% (300) classified as gifted and talented.

Population Sample

The intact groups that will be participating in this study must be taught by the same science teacher; therefore, only five potential intact groups are available for this study. Each intact group consist of a seventh grade science classroom. A cluster sampling of the five intact groups will be conducted. Two of the five seventh grade intact science classes will be randomly selected for the control and experimental groups. The control group will participate in traditional note-taking strategies, while the experimental group will partake in interactive notebooking strategies implementing left and right side activities. Both control and experimental groups will be taught by the same science teacher.

Informed Consent and Confidentiality

Before the research study can be conducted, the researcher must inform school administrators about the desire to conduct a research study in their school and school administrators must also approve the study. A letter of authorization to conduct research is located in Appendix A. Once approval is gained, parental permission of potential students participating in the study must be received in writing. The parental permission form is located in Appendix B.

Data Collection

A variety of data collection procedures will be implemented throughout this research study. Since the study will not be conducted until the start of the second semester of school, a pretest will be given to participants in both intact groups to statistically equate the groups. The pre-test is a science fall semester exam created by science department teachers (Appendix C). The questions were taken from the adopted science textbook question bank and the threat to reliability and validity are assumed to be insignificant to this study.

Participants will be observed by the researcher every day. The researcher will be making notes of strategies that seem to benefit students' academic understanding and those that do not. Observations will be recorded in a journal. Participants in the control group will partake in an interview (Appendix D) so the researcher can gather a student's perspective of the interactive notebook. The questions will focus on how students feel interactive notebook strategies affect their achievement in science. The interview will be conducted at end of each of the three six week grading periods.

District curriculum assessments will be used as a formative assessment of student achievement. The first curriculum assessment will be administered before the pre-test and will measure student achievement before participants are exposed to interactive notebooks. The second curriculum assessment will be administered at the end of the study, after exposure to interactive notebook strategies, and will compare student achievement before and after treatment within control and experimental groups; it will serve as the post test (Appendix E when received).

Instrumentation

The school district administers two curriculum assessments (CA's) to every seventh grade science student towards the end of both Fall and Spring semesters. Both CA's will be used to measure student achievement of academic content. The CA's consists of 50 comprehensive multiple choice questions over content learned throughout the semester. The data collected from the CA's will help determine the impact interactive notebooks have on participants' ability to correlate and comprehend science concepts. Since the CA's are developed by the district's internal instructional specialist, the researcher assumes the CA's will be appraised and threats to validity and reliability will be insignificant to the results of this study.

Data Analysis

The non-parametric significance test, analysis of covariance or ANCOVA, will be used to statistically analyze the pre- and post- test scores of participants in the control and experimental groups. Non-parametric tests should be used when one of the assumptions for parametric tests is breached. With the use of intact groups, this study does not fulfill the parametric assumption that participants are selected independently and "every member of the

population has an equal and independent chance to be selected for the sample" (Gay and Mills et al., 2012, p.350).

ANCOVA is chosen to help equalize the two randomly chosen intact groups based upon the control variable. Equalizing tests scores can be compared to the handicap scoring system applied in bowling competitions. The handicap allows bowlers to compete against other bowlers with various experience levels and still have an equal opportunity to win (Bowlingball.com, 2013). A lower handicap is given to participants with higher scores and a higher handicap is given to participants with lower scores to help equalize the groups (Gay and Mills et al., 2012). Tests scores from the control group will be compared to test scores from the experimental group.

Summary

Action research is the preferred research design as this study explores the impact interactive notebook strategies have on student achievement in the science discipline. A combination of qualitative and quantitative research methods will be integrated into the research design plan to help measure student achievement in various forms. Due to the nature of the study, students will not be randomly assigned to groups individually; therefore, a non-equivalent quasi-experimental design will assist with randomly assigning intact groups as a class.

This study will take place in north Texas at a local junior high school that serves seventh and eighth grade students. The population sample will include two intact seventh grade science classes that are taught by the same instructor. Even though the researcher will be the instructor for participants apart of the intact groups, permission to conduct a research study will be requested from the principal. Once the study is approved, a parental consent form will be

distributed to intact group participants, notifying parents about the nature of the study and requesting permission for their child's participation in the study.

Several data collection methods will be implemented in this study including field observations, pretest, posttests, and student interviews. The pre- and post- tests will be analyzed using a non-parametric ANCOVA statistical significance test due to the lack of individual randomization of students into groups for this study. A threat to the reliability and validity of the pre- and post-test content is assumed to be insignificant in this study.

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Appendix A

Letter of Authorization to Conduct Research

11/24/2013

Kelly Hastings
3200 Woodside Dr.
Arlington, Texas 76016

Dear Mrs. Hastings:

My name is Crystal Lee and I am a student of the Masters of Educational Technology Program at the University of Texas at Brownsville. The purpose of this letter is to request your authorization for the students of Young Junior High School to participate in an action research study about, Interactive Science Notebooks: Do Strategies Make a Difference?, at the junior high school level. This study is part of a research project for the course titled Foundations of Research in Education, taught by Dr. Ignacio Rodriguez. The purpose of the study is to determine if interactive notebooks assist with information processing and to respond to the question of whether or not interactive notebook strategies affect student achievement in science.

All information provided by each participant will be strictly confidential, anonymous and will be protected by the researcher. Each student's participation in this study is completely voluntary, and each participant will have the right to withdraw from the study when he or she desires to. It is important to mention that the information obtained in this study will be shared with my professor and his staff, for the purpose of evaluating my performance in the course. If the results of this study are published, participant's confidential information will not be divulged, and data shared will be presented without revealing the identity of the participants. Please feel free to contact me, should you have any questions or comments, by calling (682) 867-3448, or via clee12@aisd.net

Your consent to allow me to carry out this action research study is completely voluntary and by no means will affect the relationship I have with you and/or the school. I would like to remind you that you may revoke your consent at any time, even after signing this letter of consent. If you agree to consent to this study at your school, please sign and date the following section.

_____	_____	_____
Researcher's name	Researcher's signature	Date
_____	_____	_____
Name of person giving consent	Signature of person giving consent	Date

Appendix B

Parent Letter of Authorization to Conduct Research

Dear Parent/Guardian,

I am your child's 7th grade science teacher and I am currently working on an action research study. Action research involves looking closely at a teaching technique or product and examining its effectiveness. I want to increase my skill and understanding about interactive notebooks. Specifically I want to understand more about whether or not interactive notebook strategies effect student achievement in science. My goal is to improve my ability to help the students in my class be able to efficiently use an interactive notebook to improve academic success.

Participation in this activity is voluntary. Your child is free to refuse to be interviewed, surveyed, and observed. Your child may change his/her mind about participation in this activity at any time. Your child's standing in my class will not be influenced by agreeing or refusing to participate in any portion of this study. Your child will not have to do any extra work because of my study. All instruction and data collection will be conducted during the scheduled class period. My final report will not include student names or photographs. In the written report, or in charts and bar graphs, the students will be referred to as a number or a letter (student A).

If you have any questions about my plans, please contact me, Crystal Lee via e-mail, clee12@aisd.net, or by phone, 682-867-3400. You are also welcome to contact Principal Hastings at 682-867-3400 with any questions you might have. If you agree that your child is able to take part in my study, please return a signed copy of this form to me as soon as possible. You may keep the other copy for future reference. Thank you in advance for your cooperation

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I give my permission for my child_____ [name]_____ to participate in the Interactive Notebooks: Do Strategies Make the Difference? research study.

Date:_ _

Parent/Guardian Signature:_ _

Please print your name on this line:_ _

Questions or concerns about your rights in this research study can be directed to Crystal Lee, clee12@aisd.net or 682-867-3400.

Appendix C

First Semester Test – 7th Grade Science

It's the morning of July 5 in the northern California city of Cupertino. You are working the burglary watch, day shift. As commander of the electronic theft division you have a team of experts, skilled in the collection of all types of evidence relating to theft of computers and electronic stuff. At 9:50 a.m. you get a call that someone has attempted to steal an advanced chip from the Plum Computer Company. You and your team of five people respond immediately to the call. When you arrive, you find that the plant is sealed off and all the uniformed employees in the plant have been confined to a single room, the lounge. Within the hour, the missing chip is found in an envelope in a pile of mail. The envelope was addressed to Gordon Lidy, the security chief of a rival computer firm. A cassette tape was also found in the envelope.

Identify the following statements with the appropriate label below.

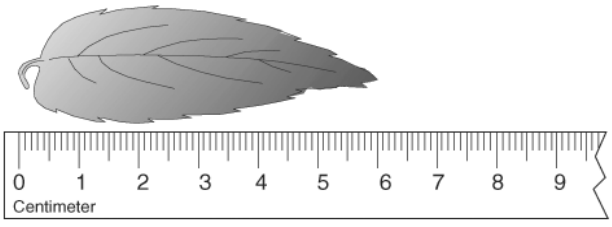
A. Qualitative Observation **B.** Quantitative Observation **C.** Inference

1. Someone who worked at Plum Computer Company tried to steal the computer chip.
2. This attempted theft took place in California.
3. Six people go to investigate the crime.

Match the type of investigation to the statement that could represent that investigation.

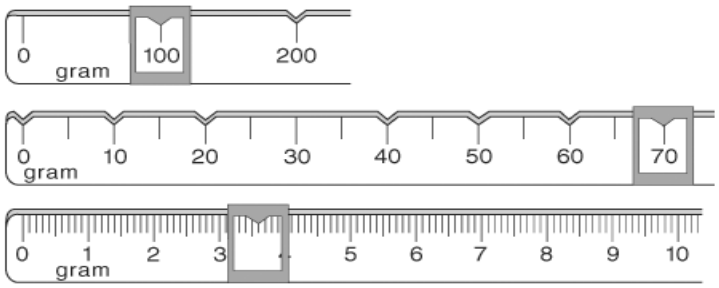
A. Descriptive Investigation **B.** Comparative Investigation **C.** Experimental Investigation

4. What is the speed of the car?
5. Can the speed of the car be affected by the surface that it is on?
6. Is there a difference between a Mustang and a Camero?



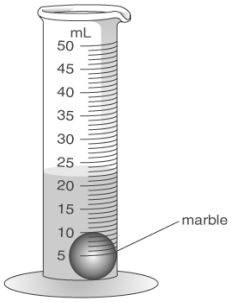
7. What is the length in millimeters of the leaf shown above?

A. 6CM **B.** 6mm **C.** 60mm **D**. 60cm



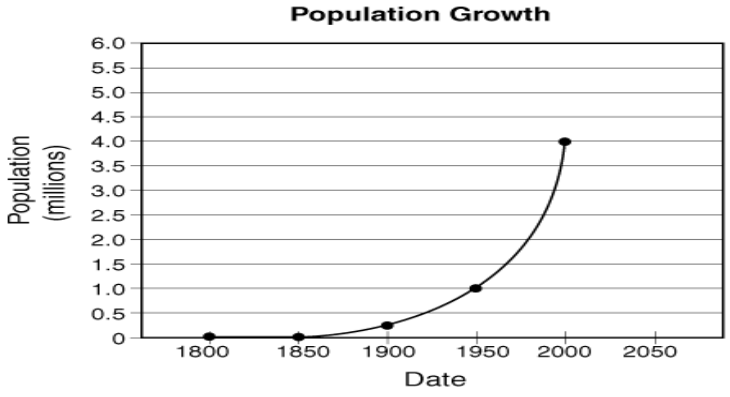
8. What is the mass shown on this balance, to the nearest tenth of a gram?

A. 173G **B.** 173.6g **C.** 100.73g **D.** 74g



9. You need to find the volume of a marble, so you place 15 mL of water into a graduated cylinder. You then carefully place the marble into the cylinder and obtain the volume shown. One milliliter is equal to one cubic centimeter (cm^3). What is the volume of the marble in cm^3?

A. 15 ml **B**. 22cm^3 **C**. 7cm^3 **D.** 10ml



10. Which label represents the manipulated variable in the above graph?

A. Populations **B**. Population Growth **C**. Date **D.** Millions

11. When a force changes an object's motion, the force is

A. balanced **B**. moving **C.** net **D**. unbalanced

12. What happens when two forces act on an object in the same direction?

A. The forces cancel each other out. **B**. The stronger force prevails.
C. The forces add together. **D.** The total force equals half the sum of the two forces.

13. The amount of matter in an object is the object's

A. weight**.** **B.** mass. **C.** force. **D**. volume.

14. The force of gravity on a person or object at the surface of a planet is known as

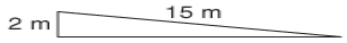
A. Mass. **B**. Inertia **C.** Weight **D.** Volume

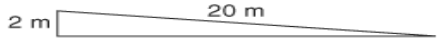
15. How much work does the girl in this image do to lift the box up onto the shelf?

A. 52 J **B.** 55 J **C.** 58 J **D.** 62 J

16. A student is using a spring scale to measure the amount of force needed to pull a toy car up a ramp. What units should the student use to record the force measurements?

A. centimeters **B.** Newtons **C.** grams **D.** meters^3

A 

B 

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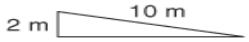
D 

17. Four inclined planes are shown. If you had to move a box that weighs 400 N a height of 2 m off the ground, which inclined plane will allow you to accomplish this using the least amount of force?

A. A **B.** B **C.** C **D.** D

18. Which of the following statements is part of the cell theory?

A. Humans are made of cells.
B. All living things are made of one or more cells.
C. All cells are surrounded by a cell wall.
D. All cells get their energy from sunlight.

19. The cells of complex multicellular organisms are organized into structures. What is the order of these structures from least complex to most complex?

A. cell, organ, tissue, organ system
B. cell, organ system, organ, tissue
C. cell, tissue, organ, organ system
D. tissue, cell, organ, organ system

20. An animal's brain controls many of the animal's activities. Which organelle has the same function in a cell?

A. the cell membrane
B. a vacuole
C. a mitochondrion
D. the nucleus

21. A plant cell wall is made of a tough, strong, and rigid material. How is this material well suited for the cell wall's function?

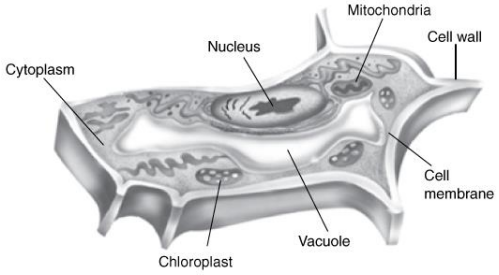
A. A tough cell wall keeps harmful substances out of the cell.
B. A cell wall removes wastes from a cell. A strong material will not tear when these wastes are removed.
C. The rigid, strong material of a cell wall allows it to provide protection and support to the cell.
D. A cell wall prevents infection. Having a rigid wall keeps out invading pathogens.

22. In plants, the organelle that converts light energy to chemical energy is called —

A. sugar **B.** chloroplast **C.** photosynthesis **D.** cell membrane

23. Look at the following pairs of organs and organelles. Which pair does not have similar functions?

A. Skin – cell membrane **B.** Stomach – lysosome
C. Heart – vacuole **D.** Brain – nucleus



24. This cell comes from —

A. an animal **B.** a bacterium **C.** an insect **D.** a plant

Kingdom	Cell Type	Unicellular or Multicellular	Cell Walls	Energy Source	Habitat or Examples of Organisms
Archaebacteria	Prokaryote	Unicellular	No cell walls	Take in food	Live in extreme environments
Eubacteria	Prokaryote	Unicellular	No cell walls	Take in food	Bacteria in soil, bacteria that cause disease
Protista	Eukaryote	Unicellular or simple multicellular	May have cell walls	Some make food; some take in food	Amoebas, slime molds, euglena, algae
Fungi	Eukaryote	Mainly multicellular	Cell walls	Absorb food	Yeast, molds, mushrooms
Plantae	Eukaryote	Complex multicellular	Cell walls	Make food	Mosses, ferns, grasses, trees
Animalia	Eukaryote	Complex multicellular	No cell walls	Eat food	Invertebrates such as sponges and worms; vertebrates such as fish, amphibians, reptiles, birds, and mammals

25. Based on the information in the table above, all bacteria —

A. are eukaryotes **B.** make food
C. live in extreme environments **D.** are one-celled organisms

26. When the heart contracts, it —

A. creates a vacuum in the blood vessels
B. exerts a force that pushes blood through the body
C. exerts a force that pulls blood through the body
D. exerts no force

27. Which of the following organs removes cellular waste products from the body?

A. lungs **B.** stomach
C. blood **D.** heart

28. Which body system produces chemicals that regulate growth?

A. digestive **B.** endocrine
C. nervous **D.** skeletal

29. Which organ breaks down food chemically and then absorbs the nutrients?

A. stomach **B.** liver
C. small intestine **D.** large intestine

30. The model above represents

A. the life story of a human **B**. the skeletal system
C. the ways a human moves **D**. the actual size of a person

31. What is the main function of the body parts shown in the picture?

A. to support the body **B**. to fight disease
C. to move the body **D**. to transport food

32. Which two systems directly work with the muscular system to bend the knee?

A. digestive and respiratory **B.** nervous and skeletal
C. skeletal and respiratory **D.** immune and circulatory

33. The bones of a bird are hollow. This adaptation helps the bird to

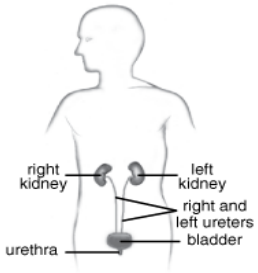
A. fly. **B.** catch worms.
C. lay eggs. **D.** swim.

34. What body tissue receives and sends signals throughout the body?

A. muscles
B. blood
C. bones
D. nerves

35. Skin is part of the body's integumentary system, which also includes hair and nails. Which of the following is *not* a function of skin?

A. Skin gives off carbon dioxide.
B. Skin regulates body temperature.
C. Skin produces vitamin D.
D. Skin prevents the loss of water.



36. What is the function of the body system shown in the picture?

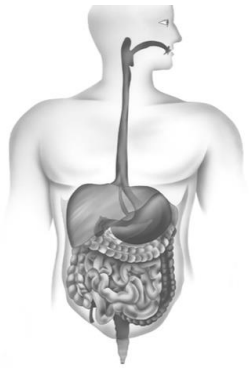
A. breaks food into chemicals that the body can use
B. removes wastes from the blood
C. sends chemical signals throughout the body
D. moves blood to all body tissues

37. What is one way that your body maintains its internal environment on a hot day?

A. Your muscles contract to cause shivering.
B. Your temperature decreases to prevent you from overheating.
C. Your brain sends a signal that results in your feeling hungry.
D. Your body produces more sweat.

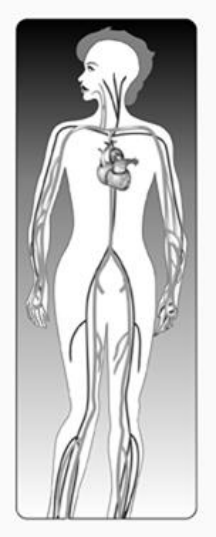
38. The excretory system includes organs that remove wastes from the body. Which organ is correctly paired with the waste product it removes?

A. kidney, glucose
B. lung, oxygen
C. liver, carbon dioxide
D. skin, water



39. What role do the body parts in the diagram play in providing cells with food?

A. The digestive system breaks down food into a simpler form that cells can use.
B. The digestive system carries food that is eaten directly to the body cells.
C. The digestive system carries wastes away from cells.
D. The digestive system releases the energy in food for use by cells.



40. Look at the diagram of a body system. What role does this body system play in providing cells with the oxygen they need to carry out respiration?

A. The diagram shows the nervous system, which signals the lungs when oxygen is needed by cells.
B. The diagram shows the digestive system, which produces oxygen for the body cells.
C. The diagram shows the muscular system, which moves oxygen to the cells.
D. The diagram shows the circulatory system, which transports oxygen from the lungs to the cells of the body.

Appendix D

Participant Interview Questions

The following interview questions will be asked at the end of the six weeks grading period.

1. How does your interactive notebook help you learn?
2. Can you show me a notebook page of which you are especially proud and share why?
3. Can you show me a notebooking strategy, used this six weeks, that you think helped you understand a concept better? How did it help you?
4. Can you show me a notebooking strategy, used this six weeks, that you think did not help you understand a concept better? How did it not help you?
5. What would you change about the way you use your notebook if you could?
6. Is there anything else you want me to know?

Appendix E

District Curriculum Assessments

The curriculum assessments have not been obtained yet, but will be included once received.