

Teaching the next Generation: Examining the Effectiveness in Learning Guided Inquiry

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Abstract

Since its introduction in the fall of 2004, Guided Inquiry has been spreading throughout the education profession. Guided Inquiry is a teaching technique that combines instruction and exploration allowing the learner to engage in active learning, ultimately creating a better understanding of concepts. Past research has identified a lack of Guided Inquiry in the South Bend and Mishawaka area. The Northern Indiana Science, Mathematics and Engineering Collaboration (NISMEC) along with others, sponsor a workshop for science and math teachers called MS-Squared in hopes of educating and encouraging the incorporation of Guided Inquiry in the classroom. However, this teaching technique still remains a new technique and requires more research, specifically in how effective the workshop is in educating the teachers how to incorporate Guided Inquiry in their already used lesson plans.

Introduction

The Northern Indiana Science, Mathematics and Engineering Collaboration (NISMEC), along with partners in the Mishawaka and South Bend area, have continued to spread the knowledge of Guided Inquiry Teaching since the fall of 2004. However, preceding research has stated: many teachers are aware of the teaching technique, but more training is needed. With previous research illustrating the shortage of the use of Guided Inquiry in the classroom, training the teachers becomes the next focus.

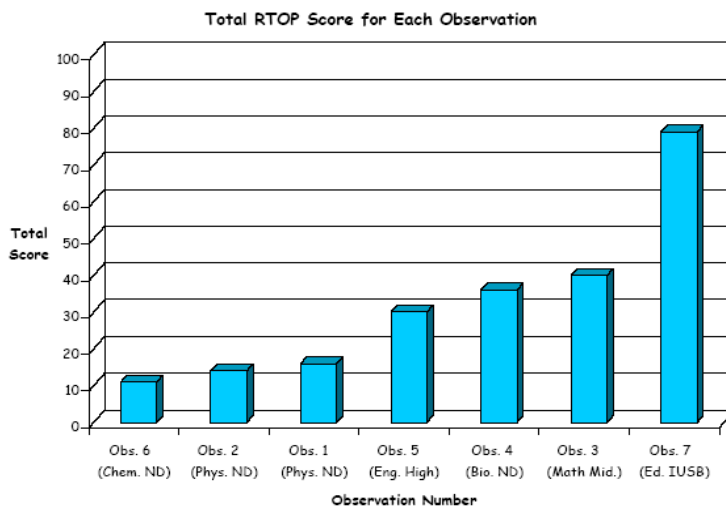
Overview of Guided Inquiry and Previous Research

Educational Inquiry is a well known teaching technique that ranges from Directed to Open. In Directed Inquiry, the direction of the lesson is completely dependent on the instruction of the teacher. In contrast, Open Inquiry relies solely on the exploration of the students with support, rather than direction, from the teacher. It is most commonly used in the teaching of sciences but can, and has, been applied to the Liberal Arts such as History. By definition, according to the National Science Education Standards,

“Inquiry is a multifaceted activity making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanation” (National Research Council, 14).

Guided Inquiry lies near the Open end of the Inquiry spectrum which allows for student exploration without the abandonment of teacher instruction. The teacher becomes more of a bouncing board and resource, than an information center. Guided Inquiry is based in the idea that the students derive a definition on their own through exploration and then the teacher gives their definition a label used in the education standards. This approach of teaching gives the students ownership of their ideas. With this sense of ownership the students are most likely to remember and be able to apply the concept they just derived. Guided Inquiry, in other words, emphasizes the practice of self discovery rather than the memorization.

The National Research Council, developers of the *National Science Education Standards*, found that, “Examination of science classrooms revealed that many were mastering disconnected facts in lieu of broader understandings, critical reasoning, and problem-solving skills” (17). Previous research in the Mishawaka and South Bend area has confirmed this observation. Using a teaching assessment called **Reformed Teaching Observation Protocol (RTOP)**, data was collected to illustrate the deficiency of the use of Guided Inquiry. The table below shows the RTOP score for each classroom observed.



The author of preceding research came to the conclusion that, “The findings of this study suggest that more effort in training and mentoring educators in the use of GI is required at all levels” (Fruge, 9). For this reason, the Middle School Mathematics and Science Guided Inquiry or MS-Squared workshop was developed. The process and success in this workshop is the subject of this paper.

MS-Squared Workshop

In an effort to educate more teachers in the South Bend and Mishawaka area about the use of Guided Inquiry in the classroom, Notre Dame hosted a three weeks of workshops for middle school mathematics and science teachers; one workshop lasting one week and another lasting two weeks. With funding from NISMEC, Siemens Foundation Educational Outreach Program, The Indiana Science, Technology, Engineering and Mathematics Network (I-STEM) and the National Science Foundation (NSF) creators and coordinators Gordon Berry (Notre Dame), Joseph J. Bellina (Saint Mary’s College), Amanda Serenevy (Riverbend Community Math Center), along with Kent Mikel and James Howard (Discovery Middle School) were able to offer different approaches and tools of incorporation. The goal of the workshops was to introduce Guided Inquiry into local science and mathematics classrooms as another tool in the box of teaching techniques. The coordinators did not intend to completely change the way a teacher approached each lesson, but to help the teacher learn how to integrate Guided Inquiry into the lesson plans they already had. The longer range goal is to persuade teachers to use Guided Inquiry all the time in their classrooms.

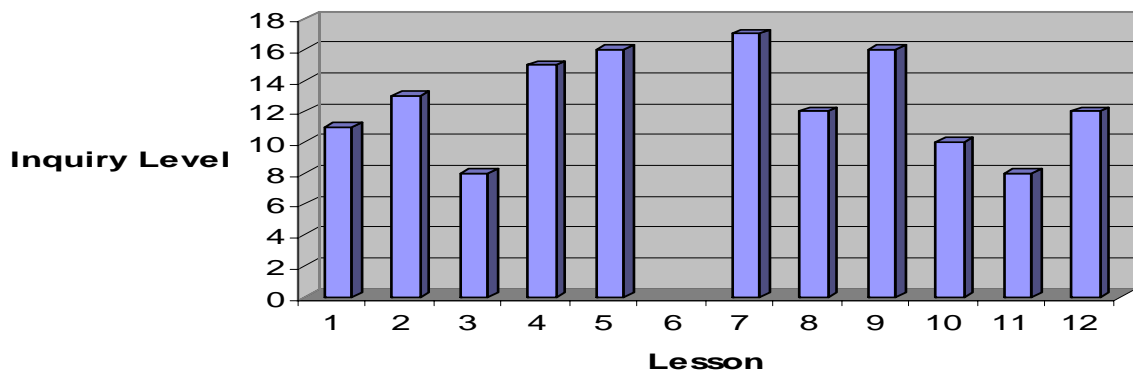
The teachers engaged in many different activities that included hands-on Guided Inquiry lessons guided by different coordinators, question and answer sessions and more importantly, revising of an original lesson plan of their own to incorporate more Guided Inquiry. Since the two week session allowed more time, participants first revised a lesson in a group setting and then another by themselves. Both revisions ended with presentations to the group followed by a question and answer period for participants and leaders. This offered numerous times for open discussion of concerns and confusion. Every afternoon the teachers would also express their questions, concerns and comments in a journal provided by the program. The journal was read every night by the coordinators and questions were answered the next day. Understanding and integration of the technique was preformed through the understanding of the five essential features of inquiry. Shown in the table below, teachers used the essential features as a guide and chose how open or directed they wanted each feature to be within their lesson plan.

Essential Feature	Variations: A	B	C	D
1. Learner Engages in scientifically oriented questions	Learner poses a question	Learner selects among questions, poses new questions	Learner sharpens or clarifies question provided by teacher, materials, or other source	Learner engages in question provided by teacher, materials, or other source
2. Lerner gives priority to evidence in responding to questions	Learner determines what constitutes evidence and collects it	Learner directed to collect certain data	Learner given data and asked to analyze	Learner given data and told how to analyze
3. Learner formulates explanations from evidence	Learner formulates explanation after summarizing evidence	Learner guided in process of formulating explanations from evidence	Learner given possible ways to use evidence to formulate explanation	Learner provided with evidence
4. Learner connects explanations to scientific knowledge	Learner independently examines other resources and forms the links to explanations	Learner directed toward areas and sources of scientific knowledge	Learner given possible connections	
5. Learner communicates and justifies explanations	Learner forms reasonable and logical argument to communicate explanations	Learner coached in development of communication	Learner provided broad guidelines to sharpen communication	Learner given steps and procedures for communication

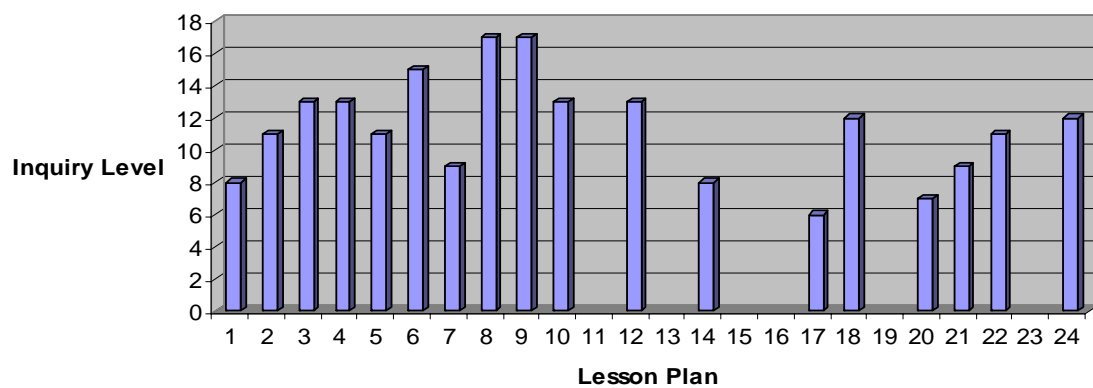
Grading the Lesson Plans

Once the workshops were over, the same table was implemented to assess the integration of Guided Inquiry in the lessons written by the teachers. Each Essential Feature was sought out within each lesson plan and assigned a level of inquiry; A being open inquiry and D being directed. In total we collected 29 lesson plans including both group and individual work. The tables below show the level of inquiry for each lesson received:

Group Lessons

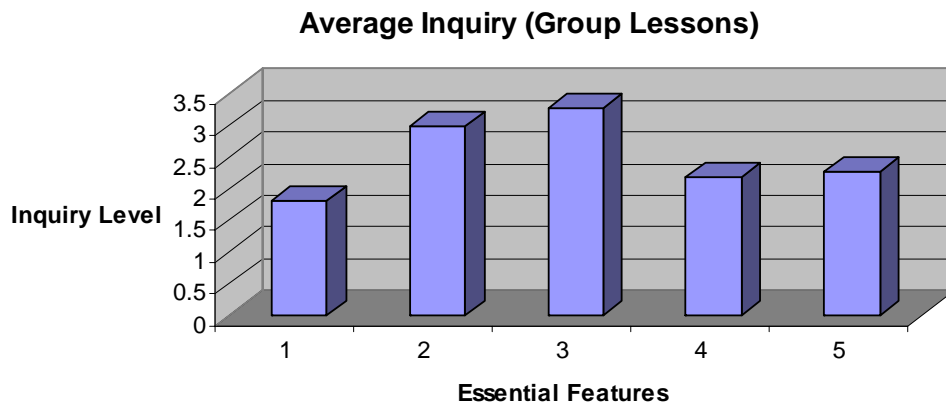


Individual Lesson Plans



Each lesson collected was given an overall inquiry scale by summing up all the essential feature levels. A score of A was given 4 points toward the overall score, B was 3 points, C was 2 and D was given 1 point. This scale sets a maximum, or Open Inquiry, at a total of 20 points and a minimum, or Directed Inquiry, at 5 points. Since Guided Inquiry tends more toward Open Inquiry the total inquiry level should range from 10 to 18 points. The tables above exemplify the success of the workshop and the teacher's ability to incorporate Guided Inquiry to their commonly used lesson plans of their own.

Through further analysis of the compositions, strengths and weakness of each essential feature can be evaluated. Using the same point system of the level of inquiry, the table below illustrates the average level of inquiry within each essential feature:



9

Two very important observations can be made from the data collected:

The first observation to be made is the improvement of the overall average inquiry level from group work to individual. Within the workshop, the lessons were revised

within groups before individual work occurred. These tables show an increase toward a more Open Inquiry approach in the fourth essential feature; the learner connects explanations to scientific knowledge. This improvement also reflects the success within the program.

A second very important observation to be made from the tables is the areas open for improvement while still keeping the lesson guided. In both collections of lesson plans the first essential feature is more directed than the rest. This feature is where the learner engages in a scientifically oriented question. By making the first question posed to the learner more directed, it allows the rest of the lesson be more open and as a result creating the overall lesson guided. Both tables show that many teachers directed their students on how to present their findings. In other words, many teachers took a very direct approach to the fifth essential feature. This is one of the improvements that can be easily done to help make the lesson more guided.

Future Work

The next step and future work include the continual education of Guided Inquiry and observation of data already collected. Workshops will continue to educate the Mishawaka and South Bend area as long as funding is provided. For the data already collected, areas of potential will be addressed and enhanced to create models for teachers in the area to use in their classrooms. This will continue the spread of Guided Inquiry as well as educated the teacher that uses the newly constructed lessons. Revisions of selected lesson plans have already begun and upon completion will be compiled to a CD that will be distributed to all the participants of MS-Squared. Visits to the classroom will also be

made to follow up these Guided Inquiry plans classrooms of the participating teachers.

An analysis of the effectiveness of the workshops and the consequent changes in the classrooms will be published as a story of the application of Guided Inquiry within a very needy school system.

Works Cited

National Research Council. (1996). *The National Science Education Standards*.
Washington DC: National Academy Press.

Fruge, Tiffany. *Examining the Use of Guided Inquiry in Local Classrooms: A Preliminary Investigation*. 2007 NSF/REU Program, Physics Department, University of Notre Dame.