

Student Learning through Inquiry: A Study of a High School Project

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Qualitative research methods were used to examine high school students' experience of an inquiry project. Student inquiry is foundational to the school curriculum in Alberta, Canada. The teacher and teacher-librarian collaboratively planned and implemented an inquiry project to engage students in developing a deeper understanding of a topic that the teachers believed would be of interest and relevance to the students, the need for greater human understanding. The primary study data came from the students who completed three reflections on their experiences, using the SLIM Toolkit forms, developed by researchers at the Center for International Scholarship in School Libraries at Rutgers University, USA.

Inquiry; student learning outcomes; SLIM Toolkit

Purpose of the Paper

The purpose of the paper is to describe and report the findings of a study of student learning where the students' learning was assessed using the SLIM Toolkit (Todd, Kuhlthau & Heimstrom, 2005). The SLIM Toolkit, variously titled the School Library Impact Measure or the Student Learning Impact Measure, was developed by researchers at the Center for International Scholarship in School Libraries (CISSL) at Rutgers University in the USA.

The overall goal of the study was to understand more fully how students build new understanding in an inquiry project. The inquiry project was framed by Kuhlthau's Information Search Process and by the outcomes of the Alberta Program of Study for high school students. There were four specific outcomes planned for the case study

1. The researcher and educators involved in the study would develop a deeper understanding of students' experiences of inquiry and of the knowledge that they gain from completing an inquiry project.
2. The students involved in the study would develop a deeper understanding of their individual and group experiences of inquiry and of the knowledge that they gain from completing an inquiry project.
3. The researcher and educators would develop a deeper understanding of the nature and timing of instructional interventions that support student learning in an inquiry project.
4. The researcher, by using the SLIM Toolkit in a context different from the context in which it was developed, might be able to contribute to the assessment of the usefulness of the SLIM Toolkit.

Unfortunately, several factors caused the project to begin later than expected and so the scope of the research project was limited. Two teachers, although initially expressing interest in the study, had to withdraw from the study—one for family health reasons, one because she was

uncomfortable with the idea of having a researcher in her class over an extended period of time. The third teacher was wonderfully generous with her time, but the timelines for the project were too short to allow the kind of researcher-teacher collaborations that were originally intended. Another serious limitation of the study was incomplete student data: getting students to complete the Reflection Sheets that they had missed due to school absence proved to be much more difficult than anticipated. For these reasons, the study findings must be considered with caution. A second study is planned for the new school year in the same school; it is hoped that the precautions taken for this second study will allow for more complete data collection across a wider range of data sources.

Background Context and Literature

Student inquiry is foundational to the Alberta school curriculum (Program of Study). Student inquiry projects are designed to engage students in developing a deeper understanding of a problem or issue of interest and relevance to them. These projects often make use of the print and electronic resources of the school library and can be collaboratively planned and implemented by the teacher and teacher-librarian, using an inquiry model such as Kuhlthau's Information Search Process. The inquiry model recommended by the Alberta ministry of education in the document *Focus on Inquiry* was based on Kuhlthau's Information Search Process (Kuhlthau, 2004; Kuhlthau, Maniotes & Caspari, 2007). I co-authored the 2004 *Focus on Inquiry* document with Jennifer Branch (Oberg, 2004) for Alberta Learning, now called Alberta Education.

The overall goal of this study was to understand more fully how high students develop new understanding in an inquiry project. The SLIM Toolkit was developed initially through work in private schools with well-established, richly resourced school library programs, with long histories of collaborative work between classroom teachers and teacher-librarians, and with well-qualified teacher-librarians. The researchers at CISSL have been supportive of other researchers who wished to use the SLIM Toolkit since studies such as mine will continue to help to assess the usefulness of the Toolkit in less privileged environments. Because the curriculum focus of the school in which the case study was conducted is inquiry learning, the principal and other educators in the school are interested in learning more about their successes and challenges in inquiry-based teaching.

Methods of the Study

Implementing an Inquiry Project

An inquiry project was implemented with Grade 10 students (first year of high school, students aged about 16) in a local suburban high school. The inquiry project was collaboratively planned and implemented by the classroom teacher and the teacher-librarian over a six-week period of time. The project was intended to support students in becoming effective researchers—developing new knowledge, understanding the nature of the inquiry process, and developing skills and strategies that enhance inquiry activities. Instructional interventions centred on: developing essential or “big” questions, developing a personal and meaningful approach to a topic, information searching, information analysis and recording of ideas, information structuring and presentation, and integrating technology throughout the inquiry project.

Participants

Approximately 30 high school students, their English teacher and their teacher-librarian participated in the study. The class was selected by the teacher-librarian in consultation. Unfortunately, because of the late start of the project, the researcher was unable to be present as a participant-observer for most of the class periods devoted to the inquiry project.

Data Collection

The primary data source was the three short questionnaires (Reflection Sheets) which students completed at three stages in the Information Search Process (Initiation, Formulation, Presentation). The researcher kept field notes during the three visits to the school. Additional data sources planned for but not, in the end, available to the researcher were the students' list of sources developed during the information searching phase of the project and their final products, essays which the students wrote in one class period.

Data Analysis

Analysis of the data was designed to enable the researcher to uncover students' base knowledge, their perceptions on levels of knowledge and their information seeking and use experience, to measure changes in the knowledge construction process, and to examine how their knowledge, attitudes and behaviours changed from initiation to presentation.

The primary data consisted of the students' responses to the six questions on the Reflection Sheets were coded and analyzed over the three stages of the project:

1. Topic knowledge (what do you know)
2. Topic interest (how interested are you?)
3. Topic knowledge (how much do you know?)
4. Development of skills for information handling and using (what do you find easy to do?)
5. Development of skills for information handling and using (what do you find difficult to do?)
6. (on Reflection Sheet 3 only) The nature of the information seeking process, as described in the 1998 AASL/AECT Information Literacy Standards for Student Learning (what did you learn in doing this research project?)

Findings from the analysis of the Reflection Sheets are reported in this paper.

Description of the Inquiry Project

The inquiry project was part of a unit of study in the English curriculum developed by the teacher on the theme of "The Need for Human Understanding." The unit was based on the reading of *To Kill a Mockingbird*, the American Pulitzer Prize-winning novel written by Harper Lee in 1960, recommended for study in the Alberta Program of Studies for Grade 10 English. The unit also included a film study of *The Boy in the Striped Pajamas*, a 2008 British–American film directed by Mark Herman and based on the 2006 internationally bestselling novel by Irish writer John Boyne. The thematic unit of study culminated with a research-based essay written in class on a topic related to the theme. Ordinarily, the teacher offered the students a list of topics

related to the novel such as “The Civil Rights Movement” or “The Trials of The Scottsboro Boys,” and the students selected a topic from the list on which to research and write an essay. The students then worked quite independently on their projects, with some time provided in the library for information searching with the assistance of the teacher-librarian.

As pointed out by the teacher, the culminating assignment for this year’s thematic unit differed in some significant ways from her previous years’ assignments. First, she designed the assignment as an inquiry project in collaboration with the teacher-librarian. Together they designed the inquiry project to provide support along the way for students’ inquiry into topics developed by the students themselves. Although the students individually wrote a final essay based on the information they had generated and collected, they worked in small groups of two or three while exploring ideas and developing their individual topics.

The teacher-librarian introduced the inquiry project by discussing with the students the importance of making their research topics personally relevant and interesting. She worked with them to create essential or “big questions” around any two of a list of “big ideas” related to the theme and to the two pieces that provided the foundation for the project, the novel *To Kill a Mockingbird* and the film *The Boy in the Striped Pajamas*. Some of the “big ideas” were “Poverty,” “Courage,” and “Segregation,” and “Racism.” The students developed their individual topics, expressed as “big questions,” which were then discussed with and approved by either the teacher or the teacher-librarian. Some sample big questions were “Can racism be stopped?” “Does non-violent protest actually work?” The students also completed an activity linking their big questions to relevant events from the 1930s-1960s and to events from their contemporary experience as well; they also began to note quotations from the novel and scenes from the film that were relevant to their topics.

Next the students began to amass information relevant to their topics, mostly using Internet sources, and recording both information and information sources on individually-created Wiki pages. As the students searched for information in the lab, the teacher and teacher-librarian circulated around the room, monitoring the students’ progress and teaching brief lessons to individuals or small groups responding to specific difficulties students were experiencing in their work. The inquiry project, including writing an in-class essay, was completed in seven 90-minute classes, extending over a six-week period of time.

Findings from the Study

The findings reported here were generated from an analysis of the Reflection Sheets from the 29 students who completed all three Reflection Sheets. The questions on the Reflection Sheets address topic interest and topic knowledge as well as the skills needed for inquiry. Inquiry skills, topic interest and topic knowledge are all important for successful inquiry projects: one student put it this way, “Searching topics I know a lot about and am extremely interested in [is easy].” Below, for each question from the Reflection Sheet, is reported: (a) the type of question, (b) the data analysis approach used for the question, and (c) the results of the data analysis.

Question 1. Take some time to think about your topic. Now write down what you know about it.

This question was an open-ended item; students could write down what they wanted and as much as they wanted. The student responses were analyzed as to the number of statements that were factual, the number that gave an explanation of some aspect of the topic, and the number that gave a conclusion about the topic. It was anticipated that students would begin with primarily statements of fact and that, as their understanding of their topics deepened, they would write more statements of explanation and conclusion. Data analysis showed that the statements made on by the students on Reflection Sheets 1, 2, & 3 were overwhelmingly factual, but those statements of explanation and conclusion that the students gave appeared mostly on Reflection Sheet 3 (see Table 1).

Table 1. Scoring of Question 1: Topic Knowledge N=29

FACT Total = 286			EXPLANATION Total = 28			CONCLUSION Total = 23		
F1	F2	F3	E1	E2	E3	C1	C2	C3
93	103	90	8	9	11	4	6	13

Question 2. How interested are you in this topic?

This question was a forced choice item, scored 0 for “not at all,” 1 for “not much,” 2 for “quite a bit,” and 3 for “a great deal.” The average score topic interest for Reflection Sheet 1, completed at the initiation of the project was 1.96, just under 2.00 or “quite a bit.” The average score decreased slightly for Reflection Sheet 2 (to 1.86) but increased slightly for Reflection Sheet to 2.10, or just over 2.00 or “quite a bit.” The slight increase in topic interest over the life of the project is consistent with the Interest Corollary of Kuhlthau’s Uncertainty Principle—that is, that interest increases as the inquirer learns more about the topic, especially as exploratory work leads to the formulation of a focus for the inquiry (Kuhlthau, 2004). The interest level expressed at the initial stage of the project is relatively high, however, and may be explained by the high level attention given by the teacher and teacher-librarian to the exploratory or discovery stage of the inquiry project—discussing the novel and film chosen for their relatedness to the theme “The Need for Human Understanding,” working in groups to create “big questions” about the sub-themes, and relating the sub-themes to historical and contemporary events.

Question 3. How much do you know about this topic?

This question also was a forced choice item, scored 0 for “not at all,” 1 for “not much,” 2 for “quite a bit,” and 3 for “a great deal.” The average score for topic knowledge increased gradually over the life of the project, from 1.34, slightly more than 1.00 or “not much,” at project initiation, 1.41 at the mid-point of the project, and 2.10, or just over 2.00 or “quite a bit” at the end of the project. This very small increase in topic knowledge over the life of the project was unanticipated and indicates the need for deeper investigation of this aspect of the project work. It may indicate that the students had insufficient time to collect information; another explanation may be that students were unable to narrow or focus their topics.

Question 4. When you do research, what do you generally find easy to do?

This question was open-ended; student responses were coded using the 1998 AASL Information Literacy Standards. The three Standards most frequently identified as being “easy to do” were:

- Able to access information efficiently and effectively (41 mentions total, 19 on Reflection Sheet 1) – Sample student responses: “I find it easy to find lots of information to use in the project,” “It was easy for me to find information when I knew what topic [subject term] to put in,” “I find it easier to use Google than Wikipedia, and also using books can help once in a while,” “The easiest was finding the website my information was on.”
- Selects information appropriate to the problem or question at hand (22 mentions total, 12 on Reflection Sheet 1) – Sample student responses: “If I really like the topic, information seems to come more easily and make more sense.”
- Able to develop questions that lead to appropriate information (19 mentions total, 7 on Reflection Sheet 1) – Sample student responses: “[I found it easy] coming up with questions,” “I can find the ‘big questions’ easily.”

Question 5. When you do research, what do you generally find difficult to do?

This question also was open-ended, and student responses also were coded using the 1998 AASL Information Literacy Standards. The three Standards most frequently identified as being “difficult to do” were:

- Able to develop questions that lead to appropriate information (25 mentions total, 15 on Reflection Sheet 1) – the most frequently mentioned difficulty was “narrowing the topic” (12 mentions), even though the students did engage in several teacher-directed activities designed to help them to narrow their topic or come to a focus. This is not surprising in that Focus Formulation (Kuhlthau, 2004) is the critical and most difficult phase in successful inquiry projects. Some students were aware of the importance of this phase of the research process; one commented, “I found it was very difficult for me to find a ‘big question’ ... I found that after I knew what I was supposed to do, doing the actual research on the topic was easy.”
- Selects information appropriate to the problem or question at hand (21 mentions total, 8 on Reflection Sheet 1) – Sample student comments: “I find it hard to know what to look for,” “I find it difficult to stay on topic,” “I have trouble deciding which pieces [of information] to take from the overall essay or paper that I am reading,” “even using my questions, it was still hard to choose between websites.”
- Derives meaning from the information (18 mentions total, 5 on Reflection Sheet 1) –the most frequently mentioned difficulty was expressed in terms of “finding it hard to put things in my own words.” Sample student comments: “Sometimes what I am reading makes no sense,” “Putting the research I find into my words [is difficult].”

In response to this question, one student referred to the emotional effect of her inquiry: “[One of things most difficult for me to do was] to hear about all the stories about racist people.”

Question 6 What did you learn in doing this project?

This question was asked only on Reflection Sheet 3, after the students had completed writing their in-class essay but before their essays had been assessed and returned to them. This question, like Questions 4 and 5, was coded and scored using the 1998 AASL Information Literacy Standards. Of the 29 students completing the final reflection sheet, 19 students responded only in terms of the content matter they had learned. The Standards mentioned most often were: Able to access information efficiently and effectively (6 mentions) and Able to communicate information and ideas in appropriate formats (4 mentions).

The most interesting responses to Question 6 were comments made by five students about self-knowledge—that is, awareness of their own learning strengths and challenges.

- “During this research project, I learned many things. First of all, I learnt to pay attention longer which is really important for me.”
- “I learned to work on this project at home because I work at a very slow pace.”
- “I learned that for me I work better alone.”

Discussion of the Initial Findings

The analysis of the data collected during the study is on-going, but preliminary indications are that the SLIM Toolkit has been an effective tool for both practice and research.

From a practice perspective, each set of the Reflection Sheets provided indications of areas for instructional interventions by the teacher or teacher-librarian, for this and future inquiry projects. For example, responses to Question 5. *When you do research, what do you generally find difficult to do?* could be used to identify skills that need to be taught or re-taught. In this study, responses to Question 5 also suggest that the teacher and teacher-librarian should continue to provide focused instruction to small groups of students who were struggling with skills such as “narrowing the topic” or “finding keywords or search terms.” Another piece of evidence supporting the need for targeted instructional interventions is the finding that two of the skills / standards identified most frequently by students in Question 4 as “easy” and in Question 5 as “difficult” were the same skills / standards—that is, “Able to develop questions that lead to appropriate information identified” and “Selects information appropriate to the problem or question at hand” (see Table 2).

Table 2. No. of Students Identifying Skills / Standards as Easy or Difficult N=29

Reflection Sheets	R1 easy	R1 difficult	R2 easy	R2 difficult	R3 easy	R3 difficult
Able to develop questions that lead to appropriate information identified	7	15	7	5	5	5
Selects information appropriate to the problem or question at hand	12	8	6	8	4	5

From a research perspective, questions arise related to the type of learning that occurred as a result of this inquiry project and to the reasons for this outcome. It appears from the Reflection Sheets that the student outcomes were primarily “the additive approach to knowledge construction,” rather than “the integrative approach to knowledge construction” (Todd, 2008, pp. 7-8). That is, all the students learned more about their topics--they acquired more factual information—but few appeared to have developed a deeper understanding of their topics that would be demonstrated through statements of explanation/reason or conclusion/synthesis. This finding is consistent with Todd’s 2006 study of 574 students from Grade 6 to 12 in ten New Jersey schools. Many questions remain, including the one that intrigues the researcher and teacher-librarian who worked together on this research: which instructional interventions might support students in developing a deeper understanding of the topics they have chosen to investigate?

Looking Forward to a Second Study

As noted earlier in this paper, a second study is planned for the new school year in the same school; it is hoped that the precautions taken for this second study will allow for more complete data collection across a wider range of data sources. Some of the changes planned for the second study are outlined below.

The Reflection Sheets will be made available and completed electronically; this will allow students who are absent on the days on which Reflections Sheets are completed to complete the sheets when they return, either in-class or out-of-class. Having the students complete the Reflection Sheets on the computer will allow the researcher to read the student data more easily; some of the handwritten responses were very difficult to read.

Arrangements will be made for the collection of additional data (e.g., students' search logs and the students' final products). Analysis of these additional data sources may generate insights, especially related to student success in inquiry as well as key enablers of that success such as the learning environment and social support. The students' final essays might provide evidence of more integrative, rather than additive, approach to knowledge construction, as demonstrated in the Reflection Sheets completed by the students in this study.

A longer time frame for the study will enable the researcher to be more involved, as was initially planned, in the development of the inquiry project, in the use of the Reflection Sheets to guide instructional interventions, and in the provision of feedback and support to the students during the project. A longer time frame for the inquiry project would also allow opportunity for students to re-frame their questions—a limitation noted by the teacher-librarian in this study.

Importance and Interest of the Study

The findings related to the understanding of the students' experience during an inquiry project appear to be consistent with those generated by the study of ten public schools in New Jersey, USA (Heinström, 2006; Heinström & Todd, 2006; Todd, 2006). The students in this study all gained in content knowledge, and the teacher found that all student essays were as good as or better than expected for these students. The students in this study developed more effective information seeking and sharing strategies, especially the skills for finding information efficiently and effectively and the skills for sharing their information in an essay format. The findings should be of interest to teacher-librarians and other educators involved in implementing inquiry-based learning in their schools.

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Biographical Note

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Statement of Originality

This statement certifies that the paper above is based upon original research undertaken by the author and that the paper was written and conceived by the author alone and has not been published elsewhere. All information and ideas from others is referenced.