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Examining Perceptions of the Science Fair Project: Content or Process?

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Preparing students to become critical readers and consumers of information challenges educators as they design and assign academic work. By looking carefully at one longstanding assignment—the science fair project—we can examine what we believe that students should accomplish in their research endeavors. Those both explicitly and peripherally involved in students' research projects—the rarely consulted "stakeholders"—may reveal the payoff or problems of such standard assignments. Informed by Information Power: Building Partnerships for Learning *(AASL/AECT 1998), the national guidelines for school library media programs dedicated to information literacy, we may think anew about students and their research projects. The guidelines suggest that the school library media specialist collaborate with members of the learning community to create a student-centered program, with information literacy as the foundation. Do age-old assignments, such as the science fair project, conform or align with such ideas?*

Typically undisputed and unquestioned as a standard school project, the science fair and other traditional research assignments find a key place in school life, somewhere between the intermediate grades and graduation from high school. Whether a school opts for the International Science and Engineering Fair (ISEF), national Olympiads, or local exhibits, students seem to understand that they, like their parents and grandparents before them, will embark on an assignment that looks and feels different from nightly homework and daily classwork. They will search for and make sense of information rather than simply recalling it. They will spend time on this assignment in and out of the classroom. They will visit school and public libraries. They will "do" something as well as read. They will spend days, perhaps weeks on such as assignment; they may talk to experts in the field. They will offer a product of their work to a broader audience than just their classroom teacher. Such an assignment differs exponentially from standard homework and classroom tasks. Kuhlthau et al. (1990,13) write that,

> The information search process . . . has three essential components: (1) it takes place over an extended period of time; (2) it encompasses a variety of sources of information; and (3) it culminates in some kind of presentation, either oral or written.

Perceived as hands-on teaching, problem-based learning (Milbury 1998), inquiry (Bibens 1980), or information literacy (Clyde 1997), such projects strive to demand more of students than a simple paper and pencil exercise that can be completed overnight. The pedagogic rationale for student research suggests that such inquiry most closely simulates what real researchers and scientists do. Kuhlthau (1997, 711) writes,

> Students learn to think through issues that do not have prescribed responses or preset solutions. Students learn to identify what is important to them, to construct new meanings, and to explain their new understanding to others in some way that is authentic to the topic.

Kuhlthau suggests that students go beyond the familiar textbook mode of right and wrong answers to enter a realm of ambiguity. Second, she notes that students select a subject area in order to inspire real investigation and prompt new understanding of their own interest. The current National Science Standards concur, suggesting that such knowledge-making may pose more than single, clear-cut results, for

> When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations. In this way, students actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills. (National Academy of Sciences 1995, 2)

In this statement, the standards presume that students undertake many steps to wrestle with their initial question. Only by engaging in the process of probing, questioning, testing, and checking may student begin to understand a topic specifically and the subject generally. Bibens (1980, 87) suggests that inquiry, "requires direct involvement of the student with subject content in the learning process, in the quest for meaning and understanding. This implies active student participation, and emphasizes understanding rather than merely knowing about a subject area." In each of these comments, one notes the emphases on inquiry and understanding rather than knowing about or knowing of a subject. Therefore, to engage successfully in research, a student investigates subject matter through many entry points, uses several levels and kinds of questioning, and assesses findings in a number of ways. Learning to trust such strategies, although at first appearing vague and indefinite, may yield rich results for questioners in both content and the investigative process.

The Problem

For purposes of trying to understand what we mean by student research, a universal and recognizable focus was sought to gain as many perspectives as possible. The science fair project represents an example of students conducting multistage and multitask research. Students have embarked on this particular assignment for generations and the science fair project as a phenomenon of student research endeavor is recognized by many. Stakeholders of the science fair project were interviewed: the teachers who assign the projects, the students who comply, the parents who assist or do not assist their child, the school library media specialists, and the reference librarians in the public library who offer resources. Interviews sought to obtain perspectives on the intended outcome of the science fair project and the assessment of what students had learned. What do stakeholders believe that students are learning and what do they say about their experiences as a stakeholder or participant in the science fair project? Do all stakeholders share a consensus on the objectives and outcomes of such an assignment? How do the resulting perceptions match with explicit standards of *Information Power,* national science standards, or with the definitions of inquiry in learning?

Generally, school districts define standards and protocols for assigning research, agreeing on the grade level and time of year for establishing a public exhibit of student projects. Whether or not the assignment is mandatory or optional, a fairly extensive infrastructure supports the research project tradition, including calling on community specialists or mentors to both advise and judge projects and relying on adequate collection development in both the school and public libraries. Traditional library resources often explain "how to implement and present a project or will give specific project ideas" (Hobbs 1989, 134). New Internet guides for online resources may offer "exciting and dynamic opportunities for collaborative, hands-on learning and problem solving that closely resemble real-life problem solving in the scientific community" (Young 1997, 36). Thus, both print and electronic sources appear plentiful, readily available, and set up for both students' and teachers' use. The sources range from illustrating models of successful projects to offering opportunities for student participation in cross-cultural data collection.

Although most implicitly agree that inquiry is important, "Most of what educators know about teaching research skills has emerged from practice and there are no formal research studies that tell us one instructional approach is better than another" (Gordon 1999, 8). Further, descriptions of both the information literacy process and library research skills models appear to be similar (Eisenberg and Berkowitz 1990). Clyde suggests that the skills of information literacy are

> Definition of a problem, deciding what information is needed to deal with the problem, deciding what sources might provide that information, locating information in those sources, analyzing and evaluating the information in terms of the problem, organizing and applying the information in working on the problem, presenting the results in a form that can be readily understood, and evaluating the effectiveness of the whole sequence of activities and sources. (1997, 48)

These skills may also be called the research process. And, she continues, "It is just as relevant to the use of the Internet as to work involving more traditional information sources" (48). Thus, engaging in research presumes information literacy. Given the vast new resources to support and assist students in their inquiry, one may begin to query the meaning of the assignment itself. What does it mean when we say that a student does a science fair project? What does it mean to do research? What does it mean to exhibit information literacy? Do implicit or tacit goals and objectives, different from the stated goals of meaning and understanding of phenomena (Bibens 1980), guide teachers, parents, students, and school library media specialists in their assignments and expectations for success?

Insight into such questions might arise from listening to the voices of those most involved with student research endeavors: the student, parent, teacher, school library media specialist, and public librarian. Their responses might offer ways to understand how novices engage in research.

Method

Phenomenological research examines what is ordinary and familiar in a situated life (Van Manen 1990,19); it offers the possibility of recognizing universal meanings. The examination of a small sample brings to light the particulars, the essential events and details that make an experience unique, rather than offer generalizations. Specific and concrete examples of the lived life help researchers and readers of research ask more questions to extend their own consideration of the phenomenon. The very nature of constructing knowledge and understanding suggests that many

interpretations can be offered to make sense of a single phenomenon. The results of such labor may be to assist one's own thinking and understanding of the nature of student research projects in general and specifically the science fair assignment.

Such qualitative work presumes the bias of caring about subjects' opinions and perceptions as one way to understand meanings of what we do. In considering the science fair as one exemplar of assigning research activities to students, we care about and appreciate the elusive qualities of intent and expectation, as well as what really happened in specific instances. In uncovering what really goes on or what people really think about assignments such as the science fair project, readers of this research may consider anew the teaching and learning of research skills and information literacy.

The research method is embedded in a constructivist perspective whereby participants are asked to consider the meaning of their own experiences. Making meaning may shed new light on previously unexamined phenomena. Dervin (1992) recommends such sense-making to help us understand how students make use of libraries generally and information specifically. Making meaning or sense of one's experiences with science fair research suggests both cognitive and affective qualities, for, "Meanings are constructs that people hold of themselves and their worlds" (Belkin 1990, 12–13). The inquiry may elicit what people say they know about a subject as well as what they feel or believe about that knowing. The phenomenological inquirer solicits narratives of others' personal experiences by interviewing them. Subsequently, the researcher probes the interview text to determine the meaning she finds in the participants' sense-making. Analyses of interview text helps to probe the meanings that participants attach to a traditional, often unquestioned assignment. This study employs a double hermeneutic (Giddens 1976), in that the research participant makes meaning of an experience (with a science fair project) by reflecting and reporting on it; the researcher then ponders the meaning or sense of another's experience, both in light of what the text reveals and what is known generally about the phenomenon.

Employing a method of reading text, by "zooming in and zooming out," researchers first read the interview text closely for both literal and interpretative meanings (Watson and Wilcox 2000). Second, they read the text widely by applying what is known about the phenomenon and establishing a context for individual comments. And, finally, the researcher offers discussion, raising questions for further study. Thus, the researcher performs three readings of interview transcripts in order to interpret meaning of the participant's responses to questions. This method of reading text has been employed to pursue qualitative research questions as well as for teaching purposes (Watson 2001).

This project began as a pilot study first to find the questions that would solicit stories of experience and second to gain a possible range of perspectives for the study of science fair project assignments. In both the pilot and the study, the methods of capturing open-ended interviews and interpreting the narrative data are similar.

With no predetermined hypothesis and very few structured questions, I tape recorded pilot and research participants' responses to the general question, "What do you mean when you say you do (teach, learn, engage in, help with) the science fair project?" Grounded theory presumes that, by seeking patterns and identifying new questions that arise from the rich data of participants' stories, one may make new sense of the phenomenon. Carini reminds us

> There can of course be no final resolution or explanation of a phenomenon through descriptive research. That is not its function. Rather its function—. . . is to verify the extent and limits of the currently available meanings of a phenomenon and to share those meanings in thinkable form with other inquirers, who in turn will further illuminate the extent and limits of the phenomenal meaning of the event through their observation. (1975, 40)

By exploring a small number of stakeholders of one assignment may offer in-depth and detailed information revealing particular or unique insights from real experience. Teachers and school library media specialists may consider the phenomena of their work by examining the perceptions of those whom they serve.

The Pilot Study: A Range of Expectations

The pilot study included interviewing a high school teacher (BB), a parent (RW), and one school library media specialist (LT) in order to learn how to frame questions regarding the science fair project. The interviews sought to determine if, indeed, the research project continues to be a universal and traditional assignment for contemporary school students, and second, what meaning a teacher, parent, and school library media specialist make of such an assignment to ensure a worthwhile and rich research study.

The interview texts from the pilot study suggest that the teacher, parent, and school library media specialist offer varying positions regarding what it means to do a science fair project. Key differences include whether learning resides in exploring new content or learning through a process of inquiry. In the selections below, I share the range of viewpoints that inspired my continued study. For example, the high school teacher (BB) suggests that selecting and learning content, inspired by a genuine interest represent the point of doing research. However, the father (RW) suggests that the point of the science fair project is that he and his son learn how to negotiate within their family dynamic. The school library media specialist (LT) suggests that the point of the science fair project is to introduce the resources of the library to both teachers and students. These perspectives vary widely in how three stakeholders perceive the assignment.

> First . . . there really needs to be some kind of curiosity. And when there isn't that, it's basically an assignment . . . I've found that when the kids come up with an idea that interests them it just makes things go better. I start them off by saying, "What have you ever wondered about? Why is the sky blue? Why is the grass green?' . . . Do talk show hosts talk more than their guests? And is it different by network or by program?". . . You know, it's an experience. And you can do a nice project on that. It's coming up with the idea . . . as long as it involves experimentation to find the answer. (BB)

For BB, an initial interest in content drives the query and provides the motivation to the process of inquiry. Without student curiosity about and commitment to the self-selected question, he claims, "It's basically an assignment" rather than an extended project. His own teaching experience suggests that if students spend little or no time exploring the selection of the idea, "During the Christmas holidays, the kid changes his mind totally into a new project; does all of the work, maybe; then starts thinking about writing up the final report. They didn't like the idea they had to begin with." The teacher expresses dismay at how difficult he finds communicating his "initial statement about what I'm looking for: considering an idea, as opposed to looking for

a project." In wrestling with the interview question about what it means to assign the science fair project, he wonders out loud, "Why aren't people interested in really learning?" Although he holds the learning of content paramount, BB feels thwarted in his efforts to inspire students who perceive that the minimal completion of a project—exclusive of new learning—complies with the teacher's assignment. BB's intentions to engage students to research their own ideas matches the best pedagogy: students learn when the subject matter holds personal interest, relevance, and meaning. Coming up with an idea offers a key to student success in research, but BB wonders about such little interest in learning in general.

The father of an only child says,

> One type of thing he [son] learned, or maybe re-learned, is how the family works. What my role is, and what my wife's role is . . . the kinds of questions that we ask, the interactions, the grumbling of 'why don't you know more?' [about the assignment]. He has a lot of difficulty in deciding which particular project he's going to do. He'll come up with two or three ideas, but it's difficult for him to select one, so we have to push him on that and we may select one for him because he can't seem to make up his mind based on material availability and local resources . . . We spend a fair amount of time on trying to figure out what the teacher wants . . . I think there's a face issue, and a kind of a family face issue. People are going to go there (the exhibit) and they're going to say, "Well, gee, that's the Smith Boy. This is pretty terrible, isn't it?" (RW)

This parent's statement is not unusual. The tension in families regarding who does the student's assignment and about the level of standards of homework offers much to negotiate. Understanding the teacher's point of the assignment, or the rubric and standards for assessing the assignment, might alleviate such tensions for this family who wonders "what the teacher wants". Furthermore, this father raises a second problematic issue: the public exhibit. He perceives that the family's reputation is on display, not just the child's work. But this father's comment about selection of idea or project based on availability of resources mirrors many students' selection process—the easy access of information rather than genuine inquiry. In order to expedite the project; in order to economize on a project, parents may drive the idea selection. Those teachers who wish for students' genuine interest and inquiry become thwarted in the first critical step. Additionally, the fact that one father selects an affective outcome for doing science fair projects—getting to know "how his family works"—suggests expectations very different from the teacher's (BB) goal for engaging in such research.

The school library media specialist suggests that,

> [The teacher] has lots of projects and is very creative and willing. They probably come in six to seven times a year, in small increments—all working up to a final project at the end of the year. We teach . . . one whole three-to-four-day unit on print versus electronic format. What are the keywords, how do you print, how can you save paper and reduce the size of the print, how do you tab through and isolate, is there an icon on this software that will . . .? And we're all out here with twenty kids throughout the library looking for that information . . . Four pieces of software are the backbone of research, at least in our library. So, we've got MAS, a periodicals and newspaper index; we have SIRS, a full text, social science, humanities and science articles; and Newsbank, with 150 full text domestic newspapers . . . And we teach the kids how to look for those things, how to scan

> an article. I have more resources than just books I can pull. I want to show them CD-ROMS. Otherwise, we may as well open up the books for them . . .Then we start talking about what terms to use—the keywords in our electronic data . . .Then we go to the Internet . . .Generally, I do the book marking. . . . (LT)

The school library media specialist perceives the library resources as rich and appropriate for student research assignments. She collaborates by working with teachers to teach the students what resources are available and how to use them. She takes a leadership role in teaching the technical skills of how to access and collect information. LT embraces a developmental approach to information literacy, referring to, "six to seven visits a year in small increments." She adds, "the basic skills (in information literacy) begin in middle school . . . and we start building from there." Addressing the question, "what do you mean when you say you help with the science fair project?", this school library media specialist seems to suggest that she gets to share her professional expertise and her resources in teaching the process of locating information.

The adults speak from their own personal experience and insight regarding the science fair project, as teacher, parent, and school library media specialist. Each of their stories reveals a particular perspective regarding the universal question of the science fair project. Their viewpoints represent a range of considering cognitive, technical, and affective learnings.

The varying ways they engage with the assignment extend and enhance the students' solitary experience. The two educators' responses reveal their professional interest and expertise in guiding such projects. The parent's response sheds an interesting, affective stance on one child's experience. As the pilot participants represented two different school systems, the author began to wonder if a cluster of stakeholders within a single school, around a single assignment, might yield a similar array of perspectives regarding the point of the assignment. For the subsequent case study of a single school, the level of stakeholders' agreement on the payoffs of such an assignment was explored.

The Science Fair Case Study

Participants

Participants were sought in a medium-sized town (under 50,000) whose school district is known for excellence in teaching and whose teacher salaries are higher than other districts in the state (Tennessee Education Association 2000). Public school students in this town have benefited from family and community interest in strong educational programs. Additionally, the district typically boasts winners of state and regional levels in the annual science fair.

After gaining approval from the district assistant superintendent, the author was directed to one middle school, whereby the principal requested two seventh grade science teachers (TT and JM) engage in the inquiry. The teachers had determined that, after several years of preparing all their students for the regional science fair, they now only work with a volunteer "group of students after school. We also had parent mentors with the after-school program" (TT). Thus, the traditional class assignment for science fair participation no longer exists for this seventh grade. Self-selected students now engage in science fair projects as an extracurricular activity to participate in what used to be a universal assignment. Nevertheless, each teacher supplied me with a list of students who had completed a project in their basic science class the previous year.

From a total of twenty-four students receiving letters of invitation to participate in the research project, seven forms were completed and returned. Two had only parent signatures; another two had only student signatures. Only three correctly contained the requisite signatures of both parent and child. The three students involved in the research were "A to A- students" (TT).

As a result, in order to hear the perspectives of a single cluster of stakeholders of the science fair project, I interviewed three middle school students, including two females and one male; their parents (3); their teachers (2), their school library media specialist, and their local public reference librarian. Each of the ten interviews was individually scheduled and held at a place of choice by the research participant: at their work, school, home or public library. I interviewed students and their parents at times and in places different from each other.

Each participant responded to the general question, "What does it mean to do the science fair project?" and spoke of their personal experiences. I discouraged general philosophizing about the assignment, but rather, steered remarks in the direction of the interviewee's direct involvement, as teacher, student, parent, or librarian. I wanted to know what each thought students learned or gained from such an assignment. I probed about real experiences of learning, as well as intended learning.

Interviews ranged from approximately twenty minutes (students) to one hour (teachers, librarians, and one parent). I transcribed the interviews and most of the participants read their own for veracity. Two school library media specialists also read and commented on the final paper as a way "to address the issue of trustworthiness of the research" (Guba 1981).

Little generalization can be made from a small sample of ten. This particular town's population may represent an outlier sample for the state. Additionally, seven out of twenty-four returns constitute a low response. The three out of seven respondents who accurately completed forms may exhibit a higher motivation than the others do to report on their work. And, with relatively short interviews by an outsider from the university, participants may guard themselves against revealing deep feelings or stories of frustration. We know, too, that one may perceive phenomena idiosyncratically. Nevertheless, reading anecdotes of lived experiences may offer school library media specialists and teachers new ways to consider a tried and true assignment that often remains unexamined.

Results

Both seventh grade teachers maintain that teaching the process itself, organizing the multistep and multifaceted assignment—rather than the pursuit of content exploration—guides their teaching.

> The concept actually, the concept that they're trying to discover is really at the bottom of our list. We're looking for things like organization, long term organization as well as short term, day to day, keeping up with the papers. Um, a lot of critical thinking skills, a lot of analysis, even if it's just a sit-down assignment where we practice like, you tell me, how you brush your teeth. Break it down, step by step by step . . . and that's something that they have the hardest time with is the organization. (JM)

> [Assigning the science fair project] means we take them step by step to begin with. I mean we don't just assign it or say "go do it." And we've had to take it step by step and we have a timeline and we first go through the process of how to question and I have some forms and paper over here I can show you. How do, you know, come up with a question and we take them to the computer and there are some sites on there, that, you know, gives them ideas for where do you start looking for, like, your hobbies, your interests, your sports. (TT)

The statements reveal consensus of purpose. Although interviewed separately, the two teachers use similar terms, such as "step by step" to describe their work as instructors of the science fair project. They agree that process or procedure, over all else, serves as the point of teaching and learning to do a science fair project. Interestingly, example of brushing one's teeth, as a sample of practicing process or procedure, offers familiar content to recall, imagine, and consider. That is, first, students have content or substance (the act of brushing teeth), which they may frame by recognizing the steps to complete the act. This example of learning how to break down steps to complete such an activity works because of prior knowledge. However, learning a set of procedures to explore unknown content or questions that hold little interest may hamper genuine inquiry. Genuine exploration offers trials, miscues, wrong moves, and messy investigation, a process different from learning and employing precise linear steps and procedures to frame familiar content.

A second objective, "how to come up with a question," is supported by "computer" sites that offer prompts for considering one's "hobbies," "interest," and "sports." Perceived as aids, such tried and tested ideas promote projects that fit the linear method of inquiry. Because the sites represent universal and general interests, rather than one's personal, perhaps idiosyncratic question, learning or inquiring new content is subsumed to "the bottom of (the) list." Gaining experience in process or procedure becomes the goal, as the teachers suggest. The emphasis on steps or organization and timeline suggest that the teachers care about how students go about the business of producing an end-product. Authentic inquiry—with its stops and starts and uneven progress—may not easily find a home in such a timeline.

What do parents in these classrooms say when questioned about their child's assignment? One mother, Mom S, concurs with the middle school teachers by commenting, "I guess they [the teachers] think it's a chance to organize their [students] thoughts and go through the scientific process and think about everything through." She adds, "Oh, I'm not sure they really learned anything," suggesting that learning content is not paramount if one agrees that the point is to learn organizational and process skills. When I probe the mother for how her daughter might learn content, she responds, "probably writing papers [rather than doing posters for exhibits] . . . [because it] makes her [child] look at things more . . . Or, maybe as she gets older. She's only in the seventh grade. I guess you really can't expect a lot."

The two teachers and parent agree that the process—the step-by-step organizational skills—drives the point of the research assignment for this middle school group. The significant adults for these students concur that the content or point of learning in a science fair project includes first to teach organization skills and second to learn correct procedures for engaging in experiments. Exploring ideas or engaging in inquiry is not a paramount goal for this learning activity.

A student, S, in this class, agrees that learning the organizational process made sense. "It was good even though I didn't really like it at the time. It was a lot of work. . . . It was a good experience to learn all the different things about the science experiment." When asked if she had an hypothesis about her yeast and bread making, she replied, "We thought, I think, that the more yeast we used the more it would rise." When asked about her results, she replied, laughing, "I forgot." But, agreeing with the teachers and her mother that the organized procedures helped, S says, "If they hadn't set up all those things to use, I would've waited until the last minute." She also gained confidence about undertaking such an assignment, declaring, "I know that I can do a project if I put my mind to it." This seventh grader benefitted both organizationally and affectively from the lengthy, multistep project, gaining confidence in using a process, but remembering little to no content about her own scientific inquiry.

The local public librarian (LM) offers supporting evidence for teaching a method rather than exploring content:

> [I]f they can just find the books within the right subject area, the project will really be laid out for them. It's when they come in with a really unique, original thought that makes it hard . . . but the science teachers at that school are very well organized when they do science fair projects . . . We have science fair project idea books. In some ways it's easier to do that because you come up with a project idea book and they take it and flip through until they see one that catches their eye and they photocopy it if it's the reference copy or they take it home and they'll do that. When you have a student who comes in with something they're really, really interested in and they want to know why mouthwash bubbles, it's hard to find three sources on that, whereas if you use the idea books . . .A lot of times the science fair project is the first time that they've ever approached a librarian.

As the local librarian, LM is a stakeholder, knowing the schools, the teachers, and their methods of teaching. The school has communicated with her and she is prepared for the students' arrival to the library. She extends the approach of step-by-step procedures by stocking science fair project idea books to illustrate models of process and final results. LM shows interest when students come in with unique or original topics: finding sources for students researching unique topics challenges her. But she speaks from personal experience. She knows the teachers' expectations. She appreciates that for some, negotiating library services offers concern. Thus, she suggests that the idea books make it easier for the stakeholders involved. LM wants to serve both the student who needs to comply with the assignment and support the wishes of the teacher who has communicated that following an organized, step-by-step process—rather than inventing or creating new content—is the point of the science fair project. Thus, she offers idea books, complete with photos and outlines of many projects for young students to follow.

The school library media specialist (DD) reports, in a similar manner,

> [The point of doing a science fair project] is really a way to learn the scientific process. Developing a hypothesis and proving it. . . I'm not sure that it's pure science that's the point. [My role] is to pull materials . . . the initial piece is to pull these things. They initially come in for one session to explore the kinds of topics that we have available. Then they take the resources to the classroom and then they come back individually to get help . . . the hardest aspect is to get them to really articulate what their process is.

> They think that they know, but when they start breaking down the steps, it's very difficult for them. And to know the degree of background of material that they need. One was doing one on electricity and there's tremendous amount of information they need to grasp before they can start applying the principles [of experimentation].

DD concurs that the teachers' assignment is to learn the scientific process. She states clearly that students are not learning pure science or content, but rather learning the difficult skill of articulating the steps. She offers students resources on the topics available in the library, thus helps to shape the selection of topic, but notes that they require a lot of information before they can proceed to engage in experiments. She states that students need to know background information in order to investigate questions in a step by step fashion. DD uses the teachers' vocabulary of "breaking down steps." She understands that this assignment is about producing a project or report, but not about inquiry.

Discussion

As I make sense of the stakeholders' understandings regarding content and process above, I notice unanimity in agreeing to the teachers' goals for learning a step by step process. I do not perceive a tension between whether students must engage in genuine inquiry—a wondering about a real matter of interest—or learn the skills of managing information and time. The stakeholders make it clear that they believe students should and do learn procedures rather than learn content. However, if one agrees that genuine inquiry suggests real doubt (Schwab 1962), ambiguity and uncertainty (Gabella 1995), students must wrestle in ways with subject matter and content not discussed by these stakeholders. In her study of tenth grade English research assignments, Gordon (1999, 4) writes that "behavioral approaches, with step by step directions, do not accommodate the complex thinking processes required for doing research". And, we agree that, although standard models of teaching research offer a convenient and standard step by step procedure for teachers and students embarking on inquiry assignments, the process taught appears confining by its linearity, never suggesting that the investigation or exploration of an idea may be iterative or recursive as Kuhlthau's model suggests (Kuhlthau et al.1990). Nor do such teaching models show differentiation in time and effort spent among steps—from shaping the question to taking right and wrong turns to creating the final product of findings. Kuhlthau's (1993) model of information seeking suggests a complex process involving actions, thoughts and feelings regarding the search.

Thus, one might return to examining the nature of inquiry as an essential point of undergoing such a major assignment. How do we separate learning a process from learning content? The parent, child and librarians in this stakeholder group concur with the basic mission of the teachers to teach a process rather than content to these middle school students. In this small example, the clear communication between school and community ultimately assists students in their endeavors to accomplish the assignment as communicated by the teacher. But the assignment does not represent the kind of inquiry that real researchers do in making meaning of the problematic as defined by Kuhlthau (1997). In a literal sense, the stakeholders might believe that students have engaged in an information search process because of its length of time, its use of a variety of information sources and its culmination in an oral or written presentation (Kuhlthau et al. 1990). But the process, in its 'step by step' approach, has limited the ambiguous nature of constructing meaning and gaining understanding.

As teachers and librarians point out Websites, offer how-to books and pull resources on topics, they inadvertently limit the students' selection of topic. Such parameters of selecting and framing the initial topic limit the possibility of genuine inquiry. Second, topics that are brand new to students offer little foundation for novices to frame genuine questions. That is, if one does not know, appreciate or understand a phenomenon, how can one begin to question or wonder about its possibilities?

Perhaps many teachers consider the linear approach appropriate for younger (middle school) students so those students learn the basics of how to search for, keep track of and present information. But such a clean-cut exercise does not pretend to be about idea making or wondering, the essence of inquiry. Thus, teachers and school library media specialists who want students to pursue ideas that intrigue them enough to investigate must communicate different expectations from the step by step procedure. They must communicate that wrong turns and mistakes in thinking may offer as much information as successful efforts. They must support that such inquiry might not be pursued within a single course or class schedule, but rather, across disciplines, across the day, in flexible schedules of classroom and library with significant adults ready to assist at wrong turns, mistakes and plateau periods in the investigation. BB the high school teacher in the pilot study remarks that he does not want students to perceive research merely as an assignment, but rather, wants them to investigate an idea or an experience through a form of experimentation. The commitment to the personally selected idea, the appreciation of mistakes, wrong hunches and failure and the ambiguity in understanding new information offer a model of research very different from the step by step process described by these few stakeholders. Can school programs accommodate genuine inquiry?

Questions and Next Steps

The classroom teachers suggest that they no longer assign the science fair project to all student, but rather offer it as an extra curricular activity for those who choose it. This change in school tradition would seem to herald a new era where either very few or no long-term, student driven projects as assigned universally. Depending on other teachers of core subject matter, the science fair project or student research in any subject becomes an exclusive opportunity rather than inclusive for all. Because of preparing for standardized tests, less time appears available for in-depth learning. Project-driven work may be perceived as time-consuming and cumbersome for overall classroom management. One might generate a host of questions regarding this dramatic change in a traditional school assignment.

- Who are the students who tend to select the extracurricular opportunity to engage in research?
- Do those students not involved in extracurricular effort encounter any opportunity to engage in independent inquiry in key subject matter?
- If students do not participate in long-term efforts to study or investigate phenomena of interest, how do they acquire tools of inquiry?
- If a critical mass of students does not engage in subject matter investigations, what is the effect of use on school library media reference materials, electronic database subscriptions, or to the stability of state electronic library?
- How can the stakeholders of each child's education be persuaded that project learning—perhaps more messy and unpredictable than discrete, monitored, and universal

assignments offer students modes for questioning phenomena and for testing the questions about which they wonder?

Further study of the nature of teaching and learning during an era when schedules and accountability drive how teachers orchestrate time, materials, and assignments warrants a continued look at student inquiry efforts.

Works Cited

AASL/AECT. 1998. *Information power: Building partnerships for learning.* Chicago: American Library Association.

Belkin, N. J. 1990. The cognitive viewpoint in information science. *Journal of Information Science* 16, no. 1: 11–16.

Bibens, R. 1980. Using inquiry effectively. *Theory into Practice* 19, no. 2: 87–92.

Carini, Patricia. 1975. Observation and description: An alternative methodology for the investigation of human phenomena [online]. Grand Forks: Center for Teaching and Learning, Univ. of North Dakota. Available from ERIC, ED 127277.

Clyde, Anne. 1997. Information skills in an age of information technology. *Emergency Librarian* 24, no. 4: 48–50.

Dervin, Brenda. 1992. From the mind's eye of the user: The sense-making qualitative-quantitative methodology. In *Qualitative research in information management.* Glazier, J. and R. Powell, 61–84. Englewood, Colo.: Libraries Unlimited.

Eisenberg, Michael, and Robert E. Berkowitz. 1990. *Information problem solving: The big six skills approach to library information skills instruction.* Norwood, N.J.: Ablex.

Gabella, Marcy Singer. 1995. Unlearning certainty: Toward a culture of student inquiry. *Theory into Practice* 34, no. 4: 236–42.

Giddens, Anthony. 1976. *New rules of sociological method.* London: Hutchinson.

Gordon, Carol. 1999. Students as authentic researchers: A new prescription for the high school research assignment . *School Library Media Research* 2: 1–21. Accessed May 20, 2001.

Guba, Egon G. 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal* 29, no. 2: 75–91.

Hobbs, Jim. 1989. Library resources for science fair projects. *LLA Bulletin* 51: 134–39.

Kuhlthau, Carol C. 1993. A principle of uncertainty for information seeking. Journal of Documentation 49 (4): 339–55.

———. 1997. Learning in digital libraries: An information search process approach. *Library Trends* 45, no. 4: 708–24.

Kuhlthau, Carol C., B. Turock, M. George, and R. Belvin. 1990. Validating a model of the search process: A comparison of academic, public and school library users. *Library and Information Science Research* 12, no. 1: 5–31.

Milbury, Peter, and Brett Silva. 1998. Problem-based learning, primary sources, and information literacy. *Multimedia Schools* 5, no. 4: 40–44.

National Academy of Sciences. 1995. National science education standards: An overview. Washington, D.C.: National Academy of Sciences. Accessed May 30, 2001; www.nap.edu/readingroom/books/nses/html/overview.html#teaching.

Schwab, Joseph J. 1962. *The teaching of science as enquiry.* Cambridge, Mass.: Harvard Univ. Pr.

Tennessee Education Association. 2000. Annual state salary review. *The TEA News* 30: 6–7.

Van Manen, Max. 1990. *Researching lived experience: Human science for an action sensitive pedagogy.* Albany: State Univ. of New York Pr.

Watson, Jinx. 2001. Making sense of the stories of experience: A methodology for research and teaching. *Journal of Education for Library and Information Science* 42, no. 2: 137–148.

Watson, Jinx Stapleton, and Susan Wilcox. 2000. Reading for understanding: Methods of reflecting on practice. *Reflective Practice* 1, no. 1: 57–68.

Young, T. E. 1997. A starting guide to Internet science fairing. *Knowledge Quest* 26, no. 1: 36–38.

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