

Designing Research Projects Students (and Teachers) Love

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Consider these scenarios:

Scenario 1:

Michael is a wonderful young man. Handsome, intelligent, caring and sweet, he's better than about 99% of the rest of kids out there. But the one thing he is not is much of a scholar. He is diligent, but perfunctory, about his school assignments.

On occasion, however, Mike gets very excited about his schoolwork. Science fair is one of those times. He spends weekends conducting experiments, visiting the library, searching websites, making graphs, taking photos, and carefully designing a presentation board illustrating his findings. He is involved, working entire days consumed by his task.

One of his best projects was one he completed in the fifth grade. He wanted to determine what substance, when applied to ice would melt it the most quickly. He drilled holes in the bottoms of four or five aluminum pie plates, taped over the holes, and then filled them with water. After being left outside over night, he removed the tape, carefully balanced them on measuring cups, spread a variety of materials on top of each icy pie plate, and then diligently recorded how much water dripped through the opening each hour during the day. He used his findings to design spreadsheets and graphs. He researched facts about water, ice, and commercial de-icers. He used the information to verify his hypothesis. He practiced answering questions a judge might ask at the science fair itself. Not much here that could not be replicated. Nothing really complex.

Scenario 2

Beth's class has chosen an interesting way to examine the impact of World War II. Instead of reading from a textbook, Beth has asked for volunteers from the community to come in and be interviewed by teams of her eight grade students about what impact the war had on them, either as military personnel or as civilians.

After careful interviews, the students wrote a narrative, took digital photographs, and scanned memorabilia from the time. They looked for web-based references to the topics and terms they hear about. And finally, they used all this information to create web pages that allow them to share what they learned about their neighbors.

<<http://www.isd77.k12.mn.us/schools/dakota/war/worldwar.html>> Both students and teachers worked "overtime" to interview, write, clarify, re-write and design these pages.

At an open house, the interviewees and their families were invited in to view and comment on their web pages. Over 11,000 visitors have read these pages, including many distant family members of those interviewed.

For the past few years I have been looking at projects like these from the Mankato schools that kids and teachers love. I've been asking students and teachers to describe learning activities they remember being particularly enjoyable. And in doing so, I have found they shared many common characteristics. These characteristics tend to group themselves into three categories. Each category is briefly described below:

Assignments that matter:

1. **Motivational research projects have a clarity of purpose and expectations.** When Mike started his science fair project, he had a good guide at: <<http://www.isd77.k12.mn.us/resources/cf/welcome.html>>. On this website are also the forms which would be used to judge (assess) his completed project. An understanding of the scientific method including how to form a hypothesis and how to collect supporting data through experimentation and research is clearly stated as the purpose. This is a life-long, usable set of skills. Science fair students undertake projects worth doing, not just busy work.
2. **Motivational research projects give students choices.** Anyone who has ever attended a science fair has to marvel at the range of topics kids are interested in. Good projects surround every aspect of every branch of science from chemistry to physics to biology. Now here is the important concept: *If the purpose of the assignment is to teach the scientific method, it doesn't make any difference what the topic is!* Dig down and look at the core concepts your research assignments are trying to teach, and let the students pick a specific subject that interests them.
3. **Motivational research projects are relevant to the student's life.** For our students, World War Two and the Trojan War both just seem "a long time ago." By asking her students to interview local residents, the teacher added real faces and lives to history. The stories resonate with those doing the interviewing. So many times we ask our students to research important topics – environmental issues, historical issues, health issues - but fail to help them make the vital connection of why the findings are important to the people in town in which they live.
4. **Motivational research projects stress higher level thinking skills and creativity.** Think how different the results of a science project are than a paper that simply asks an "about" question. Hey, Mike, write a research paper about ice. Boring! Instead brainstorm an original theory, design a means of testing it, and find ways to effectively communicate your findings. Suddenly we've moved up on Bloom's taxonomy from the knowledge and inference levels right to application, analysis, synthesis, and evaluation. What fun!
5. **Motivational research projects answer real questions.** Mike didn't know at the beginning of his project what really would melt ice the best. His rather creative guess was the laundry detergent (the kind with blue specks) would do the trick. The teacher may have guessed that there was a reason people paid good money for commercial de-icer, but the fact was, he probably did not know. It was interesting to watch as the experiment's data grew. Beth had no way of knowing the stories the World War II vets would be telling. Their lives were as fresh and exciting to her as they were to her students. Unfortunately, teachers rarely ask questions to which they do not believe they know the answer. Sort of sad, really. Diminishing to the student; boring for the teacher.

Activities that involve the researcher:

6. **Motivational research projects involve a variety of information finding activities.** As media specialists we are comfortable with our familiar old primary sources of reference books, magazine indexes, and trade books. Yet the answers to many of the personal, local, and timely questions cannot be found in them. They can provide excellent background information of important facts, but often we need to talk to experts, conduct surveys, design experiments, or look at other kinds of primary sources to get precise information. The learners in these examples spent time with secondary sources too, but the generation of new knowledge through hands-on experimentation and primary sources was motivating.
7. **Motivational learning tends to be hands-on.** Mike's experiment involved using a hammer to pound nails, a camera to document his progress, a computer to generate charts, and scissors and paste to complete the poster board. Beth's student used tape recorders, scanners, digital cameras, and a web page construction program. Students are learning by doing, not just listening. Notice too, how many

corollary skills were practiced in these “research” projects: writing skills, interviewing skills, photography skills, layout and design skills, and speaking skills.

8. **The use of technology can be exciting for many students.** Whether for planning, for research, or for communication, many students find the use of technology motivating. Neither Mike nor Beth’s students used computer programs that were purposely designed to be “motivational.” Ironically, the built-in attention getters to many programs – cute animations, sounds, etc. – can actually distract the student from the purpose at hand. It is the challenge of designing containers that make good productivity tools like graphic programs, desktop publishers, and web page construction kits - the virtual equivalent of a set of LEGOs.
9. **Good projects often use formats that use multiple senses.** Beth’s students were asked to communicate their finds not only with words, but through sound and sight as well. Scanned artifacts like ration coupons, medals, and old photographs stimulated those students who may not be verbal learners. Our ability to digitize and present information is no longer restricted to the written word but now can include drawings, photos, sounds, music, animations and even movies. All are formats that carry important and often unique information.
10. **Interesting projects are often complex, but are broken into manageable steps.** Mike’s science fair project took him over 60 hours to complete and involved dozens of tasks. But early in the project, he and his dad outlined the tasks to be done and established a timeline for their completion. Checking off completed tasks in itself is satisfying and motivational, and Mike learned some corollary planning and time management skills in the process. Large projects can be overwhelming even for adults, but planning smaller steps, building timelines, creating frequent deadlines, and scheduling multiple conferences turn complexity into manageability. It’s also clear that some tasks in effective research projects often require sustained periods of time to complete, the regular 50 minute block of “library time” doesn’t always work. Flexibly scheduled library/media time is important when implementing large projects.
11. **Collaborative learning is often stimulating and results in better products than individual work.** Beth asked her students to work in pairs. Joint problem solving, assigning and accepting responsibility, and discovering and honoring individual talents helped create a synergy that resulted in better, more satisfying web pages than students working alone would have produced. Not every project needs to be a joint effort, but real-world work environments increasingly stress teamwork. Teamwork in school is not only more enjoyable, but leads to the application of practical interpersonal skills as well.

Assessments that Help by Promoting Growth and Showing Care

12. **Motivational research projects have results that are shared with people who care and respond.** Science fair participants don’t get grades. In Mike’s school they don’t even get any academic credit. Beth’s kids got the same credit as those who took a multiple choice test on World War II. So why do kids go to all the extra work? I believe kids get hooked because big people take the time to really look at the work they have done and comment on it. Lots of other students all gather on science fair day and share their findings. People take science fair seriously. The community, both physically and virtually, visited the student’s World War II web pages. Assessments and reviews by peers, experts, and neighbors (any audience beyond the teacher) are common in scouting, athletics, dramatics, 4-H, and music organizations.
13. **Learning that is assessed by an authentic tool is more meaningful than a paper and pencil test.** Mike was evaluated on his science fair project using a rubric like the one at <
<http://www.isd77.k12.mn.us/resources/cf/rubric.htm>>. This more closely resembles the criteria used in

assessing a person's performance in the real world. Mike and his dad had the rubric at the beginning of the project and used it several times to check his progress during completion of the project. It was easy to recognize both what was good as well as what needed improvement. Quality indicators like rubrics and checklists that are given to students when assignment is made can help guide learning and keep guesswork to a minimum. As students become more sophisticated in the research process, they should be expected to choose or design their own “rules of quality,” one of the indicators of a genuinely intrinsically motivated person.

14. **Samples and examples give the learner a clear idea of what quality work looks like.** Mike had a sample project to look at on the web at < <http://www.isd77.k12.mn.us/resources/cf/batteries.html>>. Beth's class next year can use the World War II site as an exemplar of a quality project. Assignments need to change enough from year to year so that copying is not possible.
15. **Well-designed projects allow the learner to reflect, revisit, revise, and improve their final projects.** While Beth's class had a completion date, students continued to edit and revise their work as they received feedback from those they interviewed and web site visitors. There is satisfaction to be gained from observed growth. Good projects, like gardens, musical repertoires, and relationships, are probably always works in progress.

So if we know all this about good research projects, why don't all teachers design them with some or all of these elements. Well, a 4th “A” sneaks in. **(Teacher) Attitude is Everything**

16. **Teachers and media specialists who enjoy authentic, project-based learning are comfortable with a loss of control over time, the final product, and “correct” answers.** If some parts of the curriculum don't get “covered,” if conflicting evidence causes confusion, or a controversial solution to a problem is suggested, these educators roll with the punches. They have the intellectual confidence to handle ambiguity.
17. **These teachers and media specialists accept active students rather than passive students.** They have developed new rules of behavior that stress student responsibility, and have trained their principals to differentiate between active learning and a classroom out of control.
18. **The professional's belief that given enough time, resources, and motivation, all students are capable of high performance is critical.** It's not just the talented and gifted student who can make choices, solve problems creatively, and complete complex tasks. These teachers and media specialists know that most students rise to the level of performance expected of them, and that great ideas can come from anyone in the class.
19. **Like media specialists, teachers who do exciting projects recognize that their expertise is in the learning and research process rather than in any particular subject area.** No longer are these folks information dispensers, but guides for information builders. The happiest teachers are co-learners in the classroom, especially when learning new technology tools. And students get the satisfaction that comes from teaching as well.
20. **Teacher enthusiasm becomes more important than ever.** The best projects I have seen have always designed by teachers who are enthusiastic about what they are doing and how they are doing it. The downside to this is that it is very difficult to create recipes for specific projects that can be easily adopted by other teachers. We can all use principles and guidelines like the ones in this article, but to say a project, no matter how well designed, is going to work for every teacher and every group of students is impossible.

21. Teachers and media specialists who work on these kinds of project know that they don't always work the first time. But they keep trying.

Conclusion

Research must matter. The research needs to be important to the researcher. If it isn't, students will go through the motions. And Johnson's First Law of School Work will kick in: *A job not worth doing is not worth doing well.* One of the best things we as teachers and media specialists can do is work very hard to make sure research projects are well designed and intrinsically motivating. Compare your next assignment to the rubric in Table One. Aim for level three in all your projects, and hope your students are lucky enough to get to do a few number 4 level tasks sometime during their school years.

Table One

A Research Question Rubric: not all research questions are created equal.

Level One: My research is about a broad topic. I can complete the assignment by using a general reference source such as an encyclopedia. I have no personal questions about the topic.

Primary example: My research is about an animal.

Secondary example: My research is about the economy of Minnesota.

Level Two: My research answers a question that helps me narrow the focus of my search. This question may mean that I need to go to various sources to gather enough information to get a reliable answer. The conclusion of the research will ask me to give a supported answer to the question.

Primary example: What methods has my animal developed to help it survive?

Secondary example: What role has manufacturing played in Minnesota's economic development?

Level Three: My research answers a question of personal relevance. To answer this question I may need to consult not just secondary sources such as magazines, newspapers, books or the Internet, but use primary sources of information such as original surveys, interviews, or source documents.

Primary example: What animal would be best for my family to adopt as a pet?

Secondary example: How can one best prepare for a career in manufacturing in the Twin Cities area?

Level Four: My research answers a personal question about the topic, and contains information that may be of use to decision-makers as they make policy or distribute funds. The result of my research is a well support conclusion that contains a call for action on the part of an organization or government body. There will be a plan to distribute this information.

Primary example: How can our school help stop the growth in unwanted and abandoned animals in our community?

Secondary example: How might high schools change their curricula to meet the needs of students wanting a career in manufacturing in Minnesota?

Enjoyable learning experiences that are both motivating and meaningful don't just happen. They require thoughtful preparation and the conscious use of lessons learned from previous successful projects. All of us who work with students on research projects need to keep asking ourselves questions like:

1. What are the barriers to better research?
2. How do we create meaningful assessment tools that can help us become more comfortable with ambiguity?
3. How do I make sure every student is intrinsically motivated to keep learning throughout his life by finding, evaluating and using information?

Hey, it sounds like life-long learning is a reality all of us, student and teacher alike!

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