What are the benefits of hands-on learning? How do I justify a hands-on approach?

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Teachers who embrace hands-on learning in science seem to recognize certain desirable outcomes and endorse student-centered instructional approaches. Research has confirmed many of the seemingly intuitive benefits of hands-on learning and has also documented a variety of unanticipated benefits. But what effects of hands-on learning are seen by advocates as most important or valuable?

Teacher Responses

- Students in a hands-on science program will remember the material better, feel a sense of accomplishment when the task is completed, and be able to transfer that experience easier to other learning situations. When more than one method of learning is accessed as in hands-on learning, the information has a better chance of being stored in the memory for useful retrieval. Students who have difficulty in the learning arena for reasons of ESL barriers, auditory deficiencies, or behavioral interference can be found to be on task more often because they are part of the learning process and not just spectators.
- Justifying why I would use hands-on science is based on all the research and methods studies that are current. They support the notion of multi-faceted bombardment of information and experiences so that the retention level is improved.
- The benefits of hands-on-learning in my school revolves around those children who are either not as academically "talented" or have not shown "interest" in school. This method tends to stimulate these type [of] students into participating and eventually absorbing information that I believe they would not get from "normal" show-me - tell-me methods.
- The single most important benefit to me is that although it requires a great deal of preparation time, once a system is developed, hands-on teaching makes teaching fun. If the kids are learning and having fun doing it, then I am having fun at my job, and I am a happier person overall.

Developer Thoughts

I hear and I forget, I see and I remember, I do and I understand
- Chinese Proverb

Although these words may not be the exact translation, they underscore the need for a hands-on approach to science teaching. Without this approach students must rely on memory and abstract thought, two methods which restrict learning in most students. By actually doing and experiencing science, students develop their critical thinking skills as well as discover scientific concepts.

- Learning by well-planned activities and experiences in a well engineered program is a quality instructional approach. It:
  - causes students to rely on the evidence instead of upon authority (encyclopedia, minister, doctor, text, teacher, parent). Most students live in an authoritarian world with little or no opportunity to practice decision-making because nearly everyone tells students what to do and when to do it.
  - provides students with a similar set of experiences so everyone can participate in discussions on a level playing field regardless of their socio-economic status. In this way, special benefits are not awarded to those who, by virtue of their wealth or background, have a greater number of experiences under their belts.
  - forces student thinking by requiring interpretation of the observed events, rather than memorization of correct responses.
  - encourages questioning of the observed events and the resulting data. When students carry out their own experiments, they become very familiar with the events and the variables involved.
  - promotes cause and effect thinking.

- "Piaget's research clearly mandates that the learning environment should be rich in physical experiences (McAnarney, 1978, p. 33).
- Bruner also stressed learning by doing. "The school boy learning physics is a physicist, and it is easier for him to learn physics behaving like a physicist than doing something else" (Bruner, 1960, p. 14). Bruner states, "Of only one thing I am convinced. I have never seen anybody improve in the art and technique of inquiry by any means other than engaging in inquiry" (1961, p. 31). Bruner points out the quick rate of change in our world and says, "the principal emphasis in education should be placed on skills - skills in handling, in seeing, and imaging, and in symbolic operations" (Bruner, 1983, p. 138).
- A hands-on approach is also advocated by some people who advocate a constructivist approach to science teaching. "Learning is defined as the construction of knowledge as sensory data are given meaning in terms of prior knowledge. Learning always is an interpretive process and always involves construction of knowledge.... Constructivism implies that students require opportunities to experience what they are to learn in a direct way and time to think and make sense of what they are learning. Laboratory activities appeal as a way of allowing students to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science" (Tobin, 1990, p. 404-405).
- Hands-on learning has been shown to increase learning and achievement in science content (Bredderman, 1982; Brooks, 1988; Mattheis & Nakayama, 1988; Saunders & Shepardson, 1984).
- Research indicates that activity-based science can improve students' attitudes toward science (Jaus, 1977; Kyle, Bonnstetter, Gadsden, & Shymansky, 1988; Kyle, Bonnstetter, McCloskey, & Fults, 1985; Rowland, 1990). "There seems to be some evidence from exemplary programs that even poorly taught hands-on science is more interesting to students than the typical textbook based program" (Penick & Yager, 1993, p. 5).
- Evidence clearly indicates that hands-on activities increase skill proficiency in processes of science, especially laboratory skills and specific science process skills, such as graphing and interpreting data (Mattheis & Nakayama, 1988).
- Activity-centered classrooms encourage student creativity in problem solving, promote student independence, and help low ability students overcome initial handicaps (Shymansky & Penick, 1981).

Summary

There are a plethora of benefits that teachers and curriculum developers adduce to hands-on learning to justify the approach in science. Benefits for students are believed to include increased learning; increased motivation to learn; increased enjoyment of learning; increased skill proficiency, including communication skills; increased independent thinking and decision making based on direct evidence and experiences; and increased perception and creativity.

Research supports many of these claims by providing evidence that the learning of various skills, science content, and mathematics are enhanced through hands-on science programs. Students in activity-based programs have exhibited increases in creativity, positive attitudes toward science, perception, logic development, communication skills, and reading readiness. These benefits seem more than sufficient justification for promoting hands-on learning. However, an important addition - it makes science fun for both the student and teacher. Given the recent concerns about science anxiety and avoidance, enjoyment of science learning seems a worthy goal to be considered in choosing instructional approaches in science.