Learning Times Two: Creating Learning Through a Children's Museum Exhibit

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Abstract
This article describes an innovative lab course in which students designed and constructed five developmentally (and locally) appropriate museum exhibits around the theme "Healthy Living." They installed these at a local children's museum, designed a pretest/posttest to assess children's learning from the exhibit, conducted children through the exhibit and the assessment, analyzed the data, and wrote up their results: The exhibits were effective in increasing children's knowledge. A content analysis of essays by the student researchers, reflecting on what they had learned from the project, revealed learning at multiple levels, from content knowledge to increased self-understanding, perspective taking, and sense of efficacy, and further suggests that students would enjoy and strongly benefit from similar projects. Lessons and suggestions for future undertakings are offered.

Keywords
developmental psychology, active learning, service-learning

There is widespread agreement among psychology educators on the importance of research experiences in the psychology curriculum. Furthermore, the American Psychological Association (APA) goals for undergraduate psychology instruction specify (Goal 2) that students come to value, understand, and be able to apply the basic research methods of psychology (Halonen et al., 2007). However, there is a large gap between our goals and our actual practices. A survey of psychology departments (Perlman & McCann, 2005) revealed that one fifth did not require research experience of any kind of their majors. Other research has shown that most core courses do not include an integrated laboratory component (Messer, Griggs, & Jackson, 1999). Although most majors take courses in statistics and research methods, such courses do little to increase students' appreciation of these fundamental tools (Sizemore & Lewandowski, 2009), and too many majors still fail to recognize psychology's basis in science (Holmes & Beins, 2009).

One of the least commonly offered lab courses is developmental psychology (Scheirer & Rogers, as cited in Perlman & McCann, 2005). This is understandable, as developmental labs present a number of unique challenges, most notably gaining access to children and obtaining institutional review board approval (Glidden, 1982; Hartley, 1980). It is also however unfortunate. Developmental psychology offers students a unique and potentially valuable chance to reflect on and make sense of their own development, and thus assist in their personal development, another of the APA instructional goals (Goal 9).

This article describes an innovative lab course in developmental psychology organized around the construction and testing of exhibits for a local children’s museum. Applied research experiences offer a powerful tool for engaging students in research at the same time as contributing to their community (Chapdelaine & Chapman, 1999). In addition, although service-learning takes many forms and varies in definition between different schools and organizations (Furco, 1996/2003), there is a large body of research suggesting potentially powerful effects of service-learning on student learning and engagement (Conway, Amel, & Gerwein, 2009; Eyler & Giles, 1999; Strain, 2005). The course thus combined the allure—and the challenges—of designing and conducting a research project, designing and building exhibits, providing a service to one’s community, and working with and helping children. It was hoped this combination would have the potential to help students advance toward multiple APA instructional goals, such as (in addition to the two already mentioned) the application of psychology (Goal 4), effective communication (Goal 7), sociocultural awareness (Goal 8), and career planning and development (Goal 10).

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Method

Participants

There were 18 students in the college class, including 13 women and 5 men, 12 of whom were Caucasian, and 6 of whom were African American. A total of 33 local school children (18 boys, 15 girls) also participated. The children ranged in age from 6 to 12 (M = 8.8, SD = 2.02) and came from a local public elementary school (N = 13), a private Montessori school (N = 14), and a public after-school program at the museum (N = 6). The last group participated during their regularly scheduled activity period at the museum; the first two groups participated through field trips arranged on the invitation of the museum director. Parental consent for the field trips was obtained by the schools via their usual procedures. All but one child were African American (N = 11) or Caucasian (N = 21).

Procedure

The college students first visited the local museum to see what exhibits it held and to identify a component that was missing and that they could reasonably fill. They chose the topic “Healthy Living.” This addressed a local need, as the majority of local children are overweight or at risk of being overweight (Fahb & Kanny, 2006), and the local public school system does not include recess as a regular part of the school day. Next, students researched what is known about young children’s understanding of their bodies, food, and exercise and identified age-appropriate learning objectives on these topics using the American Association for the Advancement of Science’s Project 2061 benchmarks (www.project2061.org).

Students next broke into five teams of two to six members, based on shared interest in a specific topic. Each team spent approximately 6 weeks to develop, design, construct, and install their exhibit (photos are available upon request). Students were resourceful, and total costs for materials were less than $150, paid out of lab fee monies. A graded weekly research log helped students document their activities, questions, and problems.

For the component titled This or That, student researchers presented children with seven unhealthy snacks (e.g., Pop-Tarts, Oreos) along with relevant nutrition information (calories, grams of fat) and asked children to generate healthy alternatives; the children could then open a box to find one healthy alternative and its health information (e.g., graham crackers have half the fat of Oreos). The component titled Pick a Meal similarly presented children with information about food groups that they could then use to make a series of choices between unhealthy versus healthy meal choices (represented with children’s toy food replicas). In the Exercise Is Fun component, students choreographed and filmed a dance video; children in the museum were asked to accompany the video (and a student researcher) twice, once with and once without a weighted vest, to simulate differences in body weight. A borrowed stethoscope allowed children to see how the increase in weight made their hearts work harder. In a segment called Fun With Weights, student researchers inserted lead weights (fishing weights and BB-shot) into more toy food replicas so their weight corresponded to their caloric value; children were asked to guess which had more calories and could check their answer on a scale. The final segment was called Welcome to the Digestive System and presented a portion of a Magic School Bus video. All of the exhibits except the last entailed an experiential component to involve children.

Next, students created a questionnaire on the materials covered in the exhibit. The quiz included seven short-answer questions (e.g., “Why is exercise good for you?”) and eight multiple- or forced-choice questions (e.g., “Sara is at a restaurant. She doesn’t know if she should eat fried chicken or baked chicken. Which should she choose?”). Testing took place over 3 days (the two regularly scheduled 75-minute class periods for the week plus the 2-hour lab period). Children were told that we had created an exhibit to help them learn about healthy living, and we wanted them to try it. They paired up with a student researcher on a first-come, first-serve basis to complete the questionnaire. Students read the questions to the children and wrote down their answers but provided no feedback at this stage. The pairs then went through the exhibits in no specified order, based simply on available space at each exhibit. Student researchers were instructed to explain directions or text where necessary, encourage children to attend to the exhibit, but not to provide any additional information aside from what was provided in the exhibit. Finally, children completed the questionnaire a second time, again without feedback. Completion time averaged approximately 40 minutes (SD = 8.4), but variations in completion time meant some student researchers tested more children than others. After testing was completed, student researchers coded their own questionnaires, then swapped completed questionnaires with a classmate, and blind coded the open-ended questions; reliability was 87%. Lastly, each student conducted individual analyses based on hypotheses derived from our literature review and wrote them up in a complete 15-page APA style manuscript. Thus, students went from project conception to completed manuscript in 12 weeks.

Although the student researchers were focused on the children’s learning, my focus was on their learning. For the final class assignment, students wrote a three- to four-page reflection essay on what they had learned about themselves and about the research process, based on guidelines from Patti Clayton’s work at the Center for Teaching and Learning at North Carolina State University. Specifically, students were asked to address (a) the most and least successful aspects of the project and what led to each, (b) what personal strengths and weaknesses had been revealed and how they might capitalize on or compensate for these in the future, and (c) their most important lessons from the project, why they were important, and how they might be used in the future. Assignments involving self-assessment have been shown to encourage student reflection (Peden & Carroll, 2008). The essays were coded for themes using a dedicated content analysis software, NVivo9. A second researcher reviewed the codes and concurred in 97% of the cases. The few disagreements were resolved through discussion.
Results

Children’s answers were tallied for the pre- and posttest in two ways: in terms of the number of correct answers and by points, where partial credit was given for partially correct answers on the open-ended questions. Analyses on both sets of scores showed that children’s understanding of healthy living improved. The number of correct answers on the posttest \( M = 11.48, SD = 3.05 \) was significantly greater than on the pretest \( M = 9.97, SD = 3.04 \), paired \( t(32) = 3.43, p = .002, d = .50 \). Similarly, the total points were greater at posttest \( M = 24.5, SD = 5.6 \) than at pretest \( M = 21.6, SD = 5.8 \), paired \( t(32) = 3.32, p = .002, d = .51 \), and three children improved by more than 10 points (range 3 to 17). Furthermore, the different student groups (public school, public after-school program, and private Montessori school) all showed comparable gains, \( F(2, 28) = .136, p = ns \).

Content analyses of the student researchers’ essays likewise revealed many responses suggesting growth. In response to the question about the “most successful” aspects of the course, students cited increases in self-understanding (mentioned by 4 students), increases in teamwork and class unity (3 students), and the opportunity to contribute to the community (3 students). However, two aspects stood out most strongly as successes in the students’ view:

1. Facilitating learning in children (12 students, or two-thirds of the class): The fact that the school children learned from the exhibit had a tremendous impact on the student researchers; in effect, the learning scores were a validation of all their hard work. As one summarized it succinctly, “We actually created learning!”

2. Creating the physical exhibits (7 students): As one noted, “After many weeks of planning, brainstorming, and implementing ideas, to have a physical representation of the class’s thoughts was the best result.”

In terms of factors that students thought contributed to the successful aspects of the course, students cited the division of labor such that each team contributed one component to the larger project (6 students), students’ teamwork and dedication (6 students), the research logs (3 students), and having a strong coordinator (i.e., the faculty member; 3 students). In contrast, the least successful aspects of the course in the students’ eyes concerned the time pressures (6 students), social loafing or lack of participation (5 students), and difficulty coordinating between groups (3 students).

In terms of what students learned about their own strengths and weaknesses, responses varied widely. The areas most commonly mentioned by students concerned their abilities (or inabilities) in terms of teamwork (7 students), leadership (5 students), and perseverance (4 students). Overall however, this was the weakest section of the reflection essays; most responses revealed little insight or analysis. For example, a senior wrote “another weakness would have to be that I am somewhat passive . . . to overcome my weakness I guess that I would have to be more open and not make such on the spot judgments of things.” This student shows neither much commitment to self-improvement (“I guess”) nor an ability to analyze what needs improvement (it is not clear how being more open would overcome or compensate for passivity). Another refused to engage with the question at all: “As I have always been active in community service oriented [sic] programs I do not feel that this project revealed anything about myself I did not already know.”

In terms of what students considered the “most important” lessons of the class, responses again varied, but three themes were common—each of which reflects APA goals (the Ns in the following are conservative, as other students presumably experienced learning in the same areas but simply failed to categorize them as their “most” important lessons):

1. Learning about themselves (8 students): Students learned about their career interests (and disinterests) and discovered unsuspected personal strengths. For example, 2 students who had always thought of themselves as followers found themselves emerging as the clear leader of their groups (Goal 9: Personal Development and Goal 10: Career Planning and Development).

2. Lessons about teamwork and group dynamics (5 students): Students learned how to work effectively with others, communicate their own ideas, and listen to others (Goal 7: Communication Skills).

3. Lessons about the realities of the research process (4 students): In the pithy words of one student, “The realities of research were also revealed to me: the time, complexity, and effort involved” (Goal 2: Research Methods).

The content analyses also revealed a few themes that arose across questions. One has already been mentioned, namely, increases in self-understanding. Another might be called a sense of empowerment. Nearly half the class (8 students) made comments suggesting that they had been surprised and impressed by what they accomplished. In the words of one, “I think that the most important thing I learned from this project is despite chaos and loads of constraints, it is possible for a group of people to work together to create something wonderful in a very short period of time.” Another concluded, “the most importance [sic] thing I have learned from this project is that with the right people, hard work, organization, and a plan anything can get accomplished.”

One student went so far as to say, “The saying, ‘anything is possible when you put your mind to it’ rings true with our project.”

One unexpected theme, arising in slightly more than half the essays (10 students), was a broadening in perspective. Students’ comments reflected a newfound recognition and/or appreciation of the perspectives of their classmates, the children in the exhibit, and even of the museum workers who create the exhibits one student had previously blithely enjoyed.

Discussion

It was clear that learning occurred on many levels in the course. The school children representing very different backgrounds all
increased their understanding of healthy living, and the college students acquired discipline-specific skills and content as well as increased understanding of themselves, others, and their community. The unexpected increase in perspective taking was especially noteworthy, as this ability is central to several theories of cognitive development (Chickering & Reisser, 1993; Perry, 1970/1998; Piaget, 1932/1965; Selman, 1980) and is also a hallmark of development during the college years (Pascarella & Terenzini, 2001; Perry, 1970/1998). Students also reveled in the simple physical accomplishment. Much academic work is largely cerebral; students have relatively few opportunities to see their work instantiated in a physical product other than a paper. Going from conceptualization through design to installation in a few weeks was an impressive achievement, and one that exceeded many students’ expectations.

However, there were also lessons in what was not learned. Most notably, students’ responses on the part of the reflection essay concerned with self-evaluations of their strengths and weaknesses were generally quite shallow. This could result from students’ relative inexperience with self-evaluation and the fact that only one reflection essay was required. There is a strong consensus among people studying service-learning that reflection is the critical component for connecting academic course work to service in a community (Campus Compact, 2001; Eyler & Giles, 1999; Hatcher & Bringle, 1997; Hatcher, Bringle, & Muthiah, 2004). More regular, in-depth reflection prompts spaced throughout the project would better support student learning.

The project did have other drawbacks. First, the time pressures were considerable; in fact, this was the problem most commonly noted by students. Because no previous coursework in developmental psychology was required, the first 4 weeks of the semester were devoted to providing an overview of developmental theories, ethics, and methodologies, leaving only 12 weeks for the museum project. Second, the scope of the project (children’s knowledge of health) was important but narrow, and students thus learned very little of the broader content of developmental psychology. Future exhibit projects could explore childhood across cultures or historical periods as a way of covering a more extensive swath of material. Both these concerns suggest that this type of project may be most appropriate for students who have already completed a basic course in developmental psychology. Third, there was the problem of social loafing. Although overall students felt that the division of responsibilities was successful, a few students did express frustration with peers who failed to contribute (because names were not given, it was unclear if one loafer was responsible for all their ire or if there were multiple loafers). This problem could perhaps be addressed if a portion of the students’ grade was based on peer evaluation of their contributions (Reuse-Durham, 2005; Sung, Lin, Lee, & Chang, 2003). Finally, the test of whether the exhibit created learning in the school children could also be improved: Results would be strengthened if the children were tested on alternate forms of the quiz and after a longer delay (the latter was precluded in our study by time and logistical constraints).

There are lessons too in what the student researchers identified as aspects that made the project successful. There was one clear theme in this regard: More than half the class remarked on the value of teamwork in general and specifically on the effectiveness of dividing the class into teams to work on individual components that together created something greater. The prevalence of this theme may reflect the fact that students rarely get a chance to contribute to something larger than their own individual assignments—but it was precisely the teamwork that allowed them to surprise and impress themselves with what they had created. Each person had responsibilities but also contributed intellectually to other components through peer reviews of the different components at multiple points during the semester. Thus, the components, and the exhibit as a whole, benefited from multiple sources of both input and critique. Given the importance of teamwork in the workforce and what it permitted in the class, it would seem desirable to offer more large-scale team projects.

However, large projects do need careful supervision. This was a second theme in students’ reflections on what made the project successful: the importance of having a leader (i.e., faculty member) to coordinate all the efforts and keep everyone on track. One other component that students identified as “surprisingly helpful” was the research logs, which aided both organization and reflection.

The final lesson was that one must care about communication. Inform the students of the project in advance so students who intensely dislike group projects or are very uncomfortable with less structured assignments can self-select out of the class. Provide opportunities for communication and critique not only within groups but between groups so students understand how their part fits into the larger whole. Clarify with community partners when students will work on site and how their products will ultimately be used. Our exhibit was removed a few months after installation to make room for yet another exhibit. And communicate your pride to your students. For instance, I made individualized Certificates of Merit for each student.

A recent meta-analysis of research on the effects of service-learning (Conway et al., 2009) suggested that service-learning can influence students’ development in multiple domains: academic, personal, social, and even citizenship. There was evidence for all of these across students’ collective comments about our project. Students reported learning about research techniques and healthy eating, their own likes and abilities, working with others, and their community. Their comments give further support for the potential of service-learning in general, and applied research projects more specifically, as a tool for student growth.

Overall, students’ essays and comments in class suggest they found the experience worthwhile. Most strongly, they show a sense of pride in what they accomplished and a new understanding of what they could accomplish. The sense of empowerment is particularly important, as a feeling of inefficacy is one of the stumbling blocks to involvement in community service (Eyler & Giles, 1999). One student summed up her experience thusly, “I would certainly call this one of the best
experiences I have had at [this] University." Faculty are encouraged to consider how they might incorporate elements of service-learning into their courses so that such sentiments, and growth, might become common.

Declaration of Conflicting Interests
The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author received no financial support for the research, authorship, and/or publication of this article.

Notes
1. In fact, "the pursuit and effect of healthy lifestyles” is the first example suggested under the learning outcome of “applying psychology to solve problems.”
2. She can now be reached at http://www.curricularengagement.com/.

References