A PORTFOLIO IN THE SCIENCE CLASSROOM

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Abstract

This article describes the use of a portfolio of work as a means of enhancing learning of a science topic with the group of students undertaking the second year of a secondary teacher training course at Vanuatu Teachers' College in 1993.

What is a Portfolio and a Portfolio Culture?

Duschl and Gitomer (1991) proposed the use of a portfolio of work in the science classroom as a method of facilitating conceptual change in students. They suggested that if a "portfolio culture" was established it would mean fundamental positive changes for teaching/learning in science classrooms.

Duschl and Gitomer define a portfolio culture as "a means of organising and expressing curriculum and instruction in ways that promote interactions around a collection of work - the portfolio. 'Culture' is meant to convey an image of a classroom learning environment that reflects a comprehensive interplay between teacher, student, and curriculum. Two basic and distinguishing characteristics of the portfolio culture classroom are the assessment-based interactions teachers have with students to monitor meaningful learning, and the project orientation of instructional activities and instructional tasks."

In addition to the two distinguishing features of a portfolio culture classroom described above by Duschl and Gitomer, other important characteristics include:

- activities that focus on basic scientific principles, i.e. evaluating knowledge claims rather than remembering facts and procedures;
- evidence of the processes of student development; and
- reflective activities around the portfolio.

There are important implications for teaching if this method is adopted. Some implications include:

- objectives which must focus on students' understanding of scientific explanations, involving assessment of evidence, knowledge claims, and data;
- activities that encourage the restructuring of explanations need to be developed; and
- student work should be considered or assessed in terms consistent with this view.

For teachers, there are some constraints and difficulties in adopting this style of learning for their classrooms. Teachers need to become judges of sound argument rather than judges of the correctness of facts. They also need to be able to set acceptable standards and communicate these and share these with students. Assessment thus becomes less fixed and more consensual.
A Portfolio Unit in a Science Classroom in Vanuatu

To investigate the ideas of Duschl and Gitomer in a classroom setting, it was decided to use elements of the portfolio culture for a two-week unit on Plate Tectonics with the science students at Vanuatu Teachers' College.

The students are in the second year of a two-year secondary teacher training course for Anglophone ni-Vanuatu. The course should prepare them to become teachers of Mathematics and Science for junior secondary classes (Years 7-10) in Vanuatu.

A unit of work in which a portfolio culture became the model for learning and assessment was likely to be alien to these students. They would not be likely to see it as relevant to the teaching situation in which they would find themselves in a few short months. Would they be convinced that the exercise would be useful in monitoring their own learning, give them practice at explanation, increase their cooperative skills and allow them to reflect on different assessment methods?

The Unit

Plate Tectonics was chosen as the topic for this study because it is topical and inherently interesting to students as Vanuatu lies adjacent to a plate boundary, sufficient print resources were available, laboratory access was not critical to the topic as the shared laboratory is only intermittently available and because it was felt that this topic is more descriptive and less dependent on prior concepts than many other topics.

Project SEPIA materials were used as a model for the construction of the task for the students. Essentially, these materials set the students a task in project format which is designed to be as realistic as possible. Items (as each piece of assessment material is designated) demonstrating progress towards completion of the major task have clearly stated requirements and assessment criteria. The portfolio becomes a folder of separate items assessed independently.

Project SEPIA (Science Education through Portfolio Instruction and Assessment) is a project funded by the National Science Foundation of the US and is being conducted in Pittsburg Public Schools (Gitomer and Duschl, 1993).

The unit in this study was designed to be completed in two weeks, occupying approximately 14 hours of class time. Seven items were required to be completed with the major or focus item being a six-page brochure entitled "Vanuatu - A Plate Tectonic Boundary". This brochure had to be attractive, accurate, informative and easily read by Year 10 students.

Other portfolio items included the results of pencil-and-paper map-related activities, a self-marked test, a concept map and reflections on learning progress. A list of the portfolio items with details and the assessment criteria for item 6 are given in the appendix.

Initially, the teacher explained to the class the nature of a portfolio culture and the educational rationale for its adoption. After some initial confusion on the part of the students, probably as a result of the paper deluge to which they had been subjected, the requirements had to be restated and clarified.
The teacher's role throughout the remainder of the unit consisted of delivering four mini-lectures (each lasting about 15 minutes) on important concepts, answering questions (mostly of a procedural nature), negotiating interpretations of requirements, supplying resources (scissors, glue, etc.), discussing students' work and compiling a diary detailing the observations and experience.

The results - from the students' perspective

Item 7, the final item, of the portfolio required the students to reflect on their experiences during the unit. Overall, they noted their initial confusion/uncertainty/reluctance about the type of learning being espoused. This uncertainty resulted in some hostility to the task and consequently a relatively slow start by some class members.

Coming to grips with the magnitude of the task and the time required became the over-riding concern after the initial settling-in period. The time constraint acting on the mix of anxiety to complete a task and the desire to know, became a frustrating but exciting feature of the remainder of the unit.

The end result was a feeling of pride in a job well done, a confirmation that they had the ability to control their own learning and an increase in cooperative spirit in the class.

One student, importantly the only one with prior teaching experience, noted the difficulties of implementing such a culture in many of the poorly resourced secondary schools in Vanuatu.

The results - from the teacher's perspective

The most striking feature of the completed work for the unit from the teacher's perspective was its quality and accuracy. In addition, the creativity demonstrated in the finished product allowed another facet of each individual student to be revealed.

Cooperation between class members improved markedly as the unit progressed. As the anxiety about the task decreased, so the nature of the classroom changed from quiet, personal work, to more noisy group discussion and argument, to more open comparison of work completed - in other words, to active learning.

Items from the portfolio requiring reflection on the nature of their own learning revealed increased awareness for many students, however some remained reluctant to take responsibility for their learning or to believe that their pupils would be able to do so. The fact that they have positive comments about this experience suggests they may be prepared to try similar activities with their pupils as they gain more confidence in the classroom.

Conclusion

The fact that students were able to take control of their own learning and to enjoy the sense of power and confidence it gave them, makes exercises such as portfolio construction worthwhile in any context. It is not claimed that this was a "pure" reflection of Duschl & Gitomer's vision; it was more an adaptation which reflected the context of a Vanuatu classroom, albeit a relatively well resourced one. Hopefully, these future teachers will be prepared to encourage their pupils to take similar steps towards control of their own learning.

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References
