

EDUCATION - A Longitudinal Study of Students' Perceptions about Science during Transition from Primary to Secondary School

Summary of Proposed Research Program for Doctor of Science Education

Title

A Longitudinal Study of Students' Perceptions about Science during Transition from Primary to Secondary School.

Abstract

Research evidence suggests that students' perceptions about science generally become less positive as they progress through the schooling system, and that this trend is more marked amongst girls. Fewer girls than boys enrol in the physical sciences in the later secondary years, and pursue careers that involve science. This study follows female students who express an interest in a scientific career at the end of primary school (Year 7 in Western Australia) during their transition from primary to secondary school to investigate the nature and extent of the changes in their perceptions about science at this time. The study will focus particularly on the ways in which female students react to the differing student/teacher relationships and the change in teaching strategies between the primary and secondary school, and the subsequent changes in their personal construction of science.

Objectives

The general research question asks whether the transition between primary and secondary school is a critical time in the forming of attitudes for future subject and career choices and, if so, whether there are school based reasons for this. Specifically, the study will investigate:

How do students' perceptions of, and attitudes to, science change during their transition from primary to secondary school?

How are students' perceptions of, and attitudes to, science affected by:

- the student/teacher interaction in the science classroom?
- the teaching and learning strategies used for science?

The study focuses particularly on girls because the research evidence suggests that girls are more likely than boys to experience greater affective change during the period of transition, and they are more likely to opt out of science in the future.

Background

The research evidence indicates that both boys and girls demonstrate a decrease in positive attitudes towards science throughout the school years (Baird et al, 1990; Schibeci, 1986; Yager & Yager, 1985); that the decrease is more pronounced amongst girls (Dekkers et al, 1991; Evans, 1988; Parker, 1987); and that the most dramatic change occurs during the transition from the primary to the secondary system (Baird et al, 1990; Eccles, 1989; James & Smith, 1985; Linn & Hyde, 1989; NBEET, 1993; Parker, 1984; Yager & Yager, 1985).

The masculine image of science is well documented (Easlea, 1986; Kahle, 1987; Kelly, 1985; Leder, 1989; Lewis, 1993; Weinreich-Haste, 1979), and is exemplified by the

greater number of males than females teaching and studying science; the predominantly male-oriented examples in text books; the gender differentiated classroom behaviours of teachers and students; the intrinsic "scientific" thinking of males; sex bias in assessment items; and the portrayal of science by the media. However, it has also been demonstrated that until the final year of primary school, interest in, and attitudes to science are not very different between boys and girls. So, given that girls may have a predisposition (because of the socialising process) to become less interested in science, what is the catalyst at this particular time?

There is little argument that boys dominate secondary science lessons in overt ways, such as answering more questions; intimidating the girls during activities; and seeking more teacher attention (Taber, 1992; Tobin, 1987; and Weinekamp, Jansen, Fickenfrerichs & Peper, 1987). Added to this is the already mentioned factor of masculine bias in science texts and assessment items. However, during the primary school years, very few science texts are used, and formal assessments are minimal, so girls are less likely to experience such bias. Further, if the dominating behaviour of the boys is apparent during science, then it may partly be neutralised by opposite behaviours with the same teacher in other lessons.

There is considerable evidence that the enacted science curriculum in secondary schools is driven by the tertiary entrance exams. Rennie (1984) and Ferguson (1991) found that primary teachers considered attitudes to science to be more important than knowledge, while the reverse was true for secondary teachers. Primary teachers made curricular decisions based on subject integration and the needs of the students, whereas secondary teachers were content driven, and saw themselves as information givers. Tobin (1987) reported that laboratory activities in secondary schools both in Western Australia and the US "tended to be of a cookbook type with little opportunity for students to plan investigations or to interpret results. The emphasis was on collecting data" (p. 41). This contrasts sharply with the degree of independence which primary students enjoy when devising ways of answering a problem (Dawson & Shipstone, 1991). Baird et al. (1990) noted the disappointment of students beginning secondary school. They believed that secondary science would be interesting, active and fun, and would involve "doing experiments, dissections, investigations and projects" (Baird et al., 1990, p. 13). Instead, the students felt like they just copied notes or watched demonstrations, and were not given any "real work" (Baird et al., 1990, p. 13).

Apart from the different views of science which primary and secondary teachers appear to hold, which then affects their teaching styles, the other change to which students may find it hard to adjust is the altered teacher/student relationship. Ferguson (1993) found that in the first year of secondary school, girls were more concerned about missing teachers, friends and the close classroom environment of the primary school, while the boys' focus was more on facilities, such as a better canteen, and organisational issues like finding their way around the school. Midgely, Feldlaufer and Eccles (1989) concluded that student/teacher relationships deteriorated after the transition from elementary school to high school, and that this had a detrimental effect on students' motivation. Girls were found to be particularly affected, although all students were vulnerable.

There are differences in the organisation of classes, teachers and subjects between the two levels of schooling: primary school classes generally have one teacher (apart from the occasional specialist) who teaches all subjects in one room; secondary students have different teachers, rooms and classmates for each subject. The primary school structure is

more conducive than that of the secondary school to close student/teacher relationships. In addition, the specialist areas and training of the secondary staff appear to lead to a greater emphasis on covering content, and a reduction of the problem solving and practical activities which are prevalent in primary school classrooms. The literature has shown that students' construction of science during the transition between primary and secondary school undergoes significant change. It may be that girls' perceptions of science suffer during the transition years because of the changes mentioned here. Perhaps it is because girls feel less comfortable in the secondary school environment that their attitudes to science become less positive.

This study will examine how the changes in the teacher/student relationship and teaching strategies during transition from primary to secondary school affect girls' perceptions of, and attitudes to, science. There is research evidence available on these changes based on large statistical information over the transition period (Baird et al., 1990; Ferguson, 1993). However, Yates (1993) noted that in large studies, the difference between what is statistically significant and educationally significant can be lost because responses from different environments could cancel each other out, and that:

for the purposes of improving teaching, what is valuable to know is the characteristics of particular students in a particular classroom; the need is for knowledge and strategies which are context-specific. (Yates, 1993, p. 56)

Therefore, qualitative research methods will be used to collect detailed data on a small number of students during their transition from primary school to high school.

Significance

The study is significant for four reasons. First, it is likely to provide new information about students' construction of science in the period of transition between primary and secondary school. It is likely to lead to a greater understanding of when and why attitudes to subject and career choices are formed, and hence contribute to more equitable subject choices in science in post-compulsory education. Second, it is likely to have implications for teaching practice by highlighting strategies that are both gender inclusive and more likely to result in improved student attitudes to science. The third area to which the study is likely to contribute is in developing transition programs in science, including those in the middle schools recently created in Western Australia. Finally, the research method used in the study is focused on gaining detailed qualitative data about a small number of students but against a background of more general quantitative information from surveys of a larger group. The combination of quantitative and qualitative methods is designed so that the small sample selected is typical of the larger group, and that the fine-grained data necessary to examine the changes in perceptions and attitudes during the transition from primary to secondary schooling can be collected in context.

Research Method

The study uses a longitudinal research design with two overlapping phases. A large sample of year seven students completed a questionnaire designed by the researcher. An attitude survey (Webster, Rigden, Medcalf, Heward, & Lovitt, 1994) was also administered to the large sample. Based on the information collected, a small number of students was selected

for the second phase, which included semi-structured interviews and classroom observation during the transition from primary to secondary school. The small sample met the following criteria: they were female; liked science in primary school; had science-related career aspirations; were high achievers; intended to enrol at the local government high school; and had their parents' permission and cooperation to participate in the study. The study is taking place in a large metropolitan high school, and its three local feeder primary schools, so that the small selected sample is accessible.

The data collection is in two stages. During stage one, the questionnaire and attitude survey was trialed, and the feasibility of following the selected students into their high school classes was examined. The structure of the interviews was tested, and the research questions were refined. The following year, in stage two, the process was repeated with another group of year seven students moving into year eight, while the first group was tracked into year nine.

Ethical Issues

Students, their parents and teachers will be involved in providing potentially sensitive information for this study. Written permission notes will be obtained from the people concerned, as well as from the principals and heads of departments as appropriate, to collect the necessary data. Because the students will be only eleven or twelve years old when they are initially approached, interviews with them will be completed in the presence of their parents whenever possible. This practice has the advantage of keeping the parents informed, and it also means that the interviews will be done out of school time, causing as little disruption to both students and teachers. The students and parents will receive feedback as the research progresses.

When the study is completed, altering the names of the people and schools will protect confidentiality.

Facilities and Resources

No special resources or facilities are required to complete the study.

Data Storage

The data storage provisions are outlined in the attached Research Data Management Plan and meet the Curtin University Research Data and Primary Materials Policy.

Timeline

Stage One

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| November Year 1: | Surveyed 30 year 7 students about science and their future. |
| December Year 1: | Selected sample of six students comprising five girls and one boy. |
| December Year 1: | Interviewed the sample of year 7 students and their parents. |
| June Year 2: | Interviewed the six students again about their experiences of year eight science. |
| December Year 2: | Interviewed original group again about attitudes to science, and career choices. |

June Year 3: Further interviews about attitudes to science, subject choices, career aspirations.

Stage Two

November Year 2: Surveyed 70 year 7 students. Administered attitude survey to 60 students.

December Year 2: Selected a sample of six students.

December Year 2: Interviewed the sample of year 7 students and their parents.

February Year 3: Lesson observations of first science lessons of selected students in year 8.

Interviews of students to ascertain their initial impressions of high school.

March/April, Year 3: More lesson observations of year 8 students.

April, Year 3: Interviews of observed students.

June, Year 3: Final observations and interviews of students.

July, Year 3: Interview non-observed students who attend other schools.

August, Year 3: Administer attitude survey to interviewed students and their classes.

May, - November, 1995: Data analysis.

June, Year 3 - July, Year 4: Writing of thesis.

Note: Because the study is longitudinal, the early stages were completed while the candidate was enrolled in coursework.

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