

ABSTRACT

Barry Dart
School of Learning and Development
Faculty of Education
Queensland University of Technology

Teaching for improved learning in small classes in higher education

Twenty-two preservice teacher education students enrolled in a Post Graduate Diploma of Education at Queensland University of Technology completed statements about their beliefs relating to learning as well as a measure of their study processes, before and after a semester course in Educational Psychology. They also indicated their preferred classroom learning environment (before) and their perceived classroom learning environment (after). They were provided with learning experiences designed to help them take more responsibility for their own learning, to develop and/or reinforce 'constructive' conceptions of learning, and to develop relational understanding of the material encountered. These practices included collaborative learning and discussion, peer teaching, learning contracts, and self, peer and collaborative assessment. Furthermore, the quality of their learning contracts was assessed using Biggs and Collis' SOLO taxonomy.

Results indicate that the level of structure of their knowledge of learning improved significantly; that reality exceeded their preferences for autonomy in learning; that achieving motive and achieving strategy decreased; and just more than half (12) of the students' assignments were evaluated as being representative of the relational level of the SOLO taxonomy. These outcomes are discussed in terms of the particular learning experiences to which the students were exposed.

Background to the study

Students in preservice teacher education programmes bring with them

considerable
informal knowledge of learning and teaching processes. Recent
conceptions of learning
emphasize that learners actively construct knowledge for themselves by
forming their own
representations of the material to be learned, selecting information
they perceive to be
relevant, and interpreting this on the basis of their present knowledge
and needs.

Focus of study

The purposes of this study were to (i) improve the ways in which

tertiary education
students in small classes engage in learning by focussing on their
conceptions of and
intentions for learning, (ii) enable students to recognize their own
relevant ideas and
beliefs; evaluate these ideas and beliefs in terms of what is to be
learned and how this
learning is intended to occur; and decide whether or not to reconstruct
their ideas and
beliefs, and (iii) improve the quality of their learning through helping
them to develop
relational understanding of the material in the course. As a result, it
was expected that
students would demonstrate positive outcomes from the programme
including declarative,
procedural, and metacognitive knowledge of the teaching/learning
process, which would
be organized in a way that would allow them to apply this knowledge
effectively.

The aims were to be achieved by helping them to become aware of and
understand their
psychological processes when learning by causing them to focus on their
own learning
experiences. To this end they were provided with opportunities to take
greater
responsibility for their own learning, as well as to learn and apply
appropriate cognitive
and metacognitive strategies associated with a deep or transformative
approach to
learning. Thus it was hoped they would be more self-regulated and
reflective in their
learning.

To facilitate the organization of their knowledge of the

teaching/learning process,
continual emphasis was given to the need for relational understanding
through making
connections: connections between aspects of the new material,
connections between the
new material and their prior knowledge, and connections between their
informal and
formal knowledge.

Many of these learning experiences and opportunities were provided in a
small group
(collaborative learning group, n=3) context in which students
discussed, shared their
understandings, and examined and evaluated their own and others'
beliefs. Thus, the
approach to teaching was based on constructivist learning theory which
asserts that
knowledge is actively constructed by the learner, and it involved
elements of social
constructivism (Prawat and Floden, 1994). As such, the approach to
teaching was based
on and extended earlier research by the writer (Dart and Clarke, 1991).

Influences on tertiary students' learning

Recent research on student learning has focussed on relationships
between students'

approaches to learning, their perceptions of their learning
environments, their personal
characteristics, and their learning outcomes (Dart, in press; Dart and
Clarke, 1991,
1992; Entwistle, 1987; Entwistle and Entwistle, 1991, 1992; Marton and
S, 1984; Prosser and Millar, 1989; Ramsden, 1992;
Ramsden and Entwistle, 1981; Trigwell and
Prosser, 1991a,b).

The central place of the learning environment and the personal
characteristics of the
learner in influencing whether students adopt deep or surface
approaches to learning is
evidenced in recent research in higher education (Dart, in press; Dart
and Clarke, 1991,
1992; Entwistle, 1987; Ramsden, 1984,; Ramsden and Entwistle, 1981).
These studies
have shown that (i) factors present in the learning context such as
good teaching,
openness to students, freedom in learning, teaching methods, assessment
methods,

vocational relevance, appropriate workload, "press for understanding", and (ii) personal characteristics such as perceived self ability and locus of control orientation, influence how students go about their learning. As well, van Rossum and Schenk (1984) found that students who reported using a surface approach to learning held a "reproductive" (quantitative) conception of learning, whereas those using a deep approach held a "constructive" (qualitative) conception of learning.

Academic teachers' conceptions and approaches to teaching

It has been suggested that the conceptions of, or orientations to, teaching that academic teachers hold may be an important influence affecting the quality of student learning (Kember and Gow, 1994; Prosser, Trigwell, and Taylor, 1994; Samuelowicz and Bain, 1992). This influence was expected to result from the effects conceptions of teaching would have on teaching methods employed, learning activities and tasks used, and assessment requirements.

However, there has been little research in the area of teachers' conceptions in relation to the categorizations proposed (Kember and Gow, 1994; Prosser, Trigwell and Taylor, 1994; Samuelowicz and Bain, 1992). There is agreement that the varying conceptions can be simplified into "teacher-centered" versus "student-centered" or "learning facilitation" versus "knowledge transmission".

Origin of the programme

As a consequence of the earlier teaching programme (Dart and Clarke, 1991) in which students reported increases in deep motive, achieving strategy, deep

approach, and deep achieving approach to learning, it was decided to vary some of the learning experiences provided in that programme, as well as measure the quality of learning outcomes.

Outline of the programme

Initial meeting

After general introductions in which the teacher and students gave their names and talked briefly about themselves, both personally and professionally, there followed a brief discussion of what Psychology, and more specifically Educational Psychology, involved.

Students were then informed of the objectives for the course, the teaching approach adopted for the course and the rationale for these. In particular, the function and importance of the collaborative learning group was emphasized: peer collaboration is essential to the learning process as learners construct meaning and understanding through active participation and sharing of knowledge (Resnick, 1987); and, a change in understanding is more likely to occur through social interactive methods that require students to explain, elaborate, and argue their position to others (Brown, 1988).

The content of the course that all students were to study was then identified: Learning (theories of learning, models of learning, and learning strategies); Motivation; Classroom Management; Learning Styles; and Teacher Expectation Effects. The content may seem limited for a one semester course of study, however, to foster understanding, which may require confronting powerful prior knowledge which may interfere with the learning experiences provided, requires time to engage in what Baird (1991, p. 102) described as "the constructivist processes of recognition, evaluation, and possible reconstruction of personal views" which encompass reflection and metacognition. Furthermore, Bain (1994) asserted that for the development of transformative understanding the curriculum needs to "be stripped", that is, "...to enable students to 'wrestle with ideas' over a sustained period, the syllabus must be reduced to a few essential generative topics" (Bain, 1994, p. 19). Previous experience supports these assertions (Dart and Clarke, 1992).

At the end of the initial meeting session, students were given a

reading task which they were to prepare for discussion in the next session. They were asked to try to get to know other group members during the week so that collaborative learning groups could be

formed at the beginning of the next session.

Learning experiences and teaching strategies

The focus of the learning experiences is the collaborative learning group, usually made up of three students who have elected to work with each other in the subject. Normally, the first part of each meeting period is organized around these learning groups. It is emphasized in the first session and during the semester, that learning is an active process and requires students to take responsibility for their own learning (with the support of the teacher and their learning group partners). Collaborative learning groups provide opportunities for students to examine and refine their understandings. What is important is that "opposing views become alternatives to be explored rather than competitors to be eliminated" (Roby, 1988, p. 173). To this end, 'conceptual exploration' is stressed rather than 'personal confrontation'.

The teacher's role in these learning group activities is to help identify students' beliefs, guide them in this approach to learning (which is a new experience for many of them), and work with them to master impediments to understanding. This is achieved through facilitating student-student interaction, using reflective feedback to enhance the nature of the discussion, and providing critical feedback related to students' contributions. As mentioned earlier, relational understanding is emphasized through connecting knowledge.

Assessment

As mentioned earlier, there were two assessment items.

(i) Teaching episode (40%)

Each member of a group 'teaches' the other students in the

group about some topic relevant to the teaching/learning process. These teaching episodes occur towards the end of semester and usually students take one hour for their presentation.

(ii) Learning contract (60%)

The effectiveness of contract learning in promoting student autonomy in learning, a sense of ownership, and intrinsic motivation, all characteristics of a deep approach to learning (Biggs and Moore, 1993; Ramsden, 1992), has been established by Dart and Clarke (1991), Knowles (1986), and Tomkins and McGraw (1988). The use of contract learning is to help students control their learning experiences to meet their own interests and needs, and so become more self-directed.

The method of assessing their contract work is given at the initial meeting, and is focussed on in following sessions until students understand clearly what is required. The product is assessed qualitatively using a procedure based on Biggs (1992) developed from the Structure of Observed Learning Outcomes (SOLO) taxonomy (Biggs and Collis, 1982), a measure of the level of complexity of structure of knowledge. This scheme identifies five categories of learning, ranging from:

"irrelevant or incorrect (prestructural), through increasing use of relevant data (uni- and multistructural), integration of data into an appropriate relationship (relational), to generalisations and applications well beyond the call of duty (extended abstract). (Biggs, 1992, p. 4)

There are three levels within each category; the level can be illustrated minimally, adequately, or very well. This type of assessment provides not only summative information, but also serves a diagnostic function in indicating to students at what stage their learning is.

Even though other studies have reported measuring the quality of student learning using a

procedure based on the SOLO taxonomy, they have either studied qualitative differences in outcomes on specific academic tasks (van Rossum and Schenk, 1984; Watkins, 1983), or differences in students' descriptions of what their course of study was about (Trigwell and Prosser, 1991a, 1991b). The exceptions to these are Boulton-Lewis (1992, in press) and Boulton-Lewis and Dart (in press) which qualitatively assessed student assignments based on course content.

Method

Sample

The students in the programme were enrolled in the Post Graduate Diploma of Education (Secondary Teaching) in 1993. They were members of a class studying Human Development and Learning 1, taught by the writer. There were 22 students for whom there is complete data. Fourteen were female and eight were male; twelve were aged less than 25 years, seven were between 25 and 30 years, and three were older than 30 years.

Data collection procedures and variables

Since the interest was in changes that may have occurred as a result of the programme, information was collected at the beginning and end of Semester 1. At

the initial meeting of the class, students completed the pre-test measures before any other activities took place. Students completed open-ended questions relating to their beliefs about learning, as well as two quantitative questionnaires, one measuring how they undertook their study in the subject, and the other asking them to indicate how they preferred their classroom learning environment to be structured. These measures were administered again at the end of the semester. Seven students volunteered to be interviewed to give their impressions of the programme. Students also completed a standard Student Evaluation of Teaching Questionnaire.

Analysis

Data analysis of the Approach and Environment variables was carried out using SPSS

Release 4.1. Since pre- and post-test data were collected to measure change, a repeated measures design, the procedure used was to carry out a multivariate analysis of variance (MANOVA) to test for the within-subject effect of Time. In both cases of Approach and Environment variables, scores for each subscale were transformed to a 5-point scale for ease of interpretation.

Student responses to the open-ended questions, pre- and post-, were analysed by a research assistant and the writer separately, using a procedure developed by Boulton-Lewis (1992, in press), which is based on the SOLO taxonomy (Biggs and Collis, 1982).

Likewise, each response, pre- and post-, was identified as representing a particular level of conception of learning using the hierarchy of Marton, Dall'Alba, and Beaty (1993).

Both SOLO and Conception variables were analysed using the Wilcoxon matched-pairs signed-ranks test accessed through NPAR tests within SPSS Release 4.1. This tests to see if there are any differences between the pre- and post- measures of the variables being tested within the one population, taking into account the size of the differences.

Transcripts of students' interviews were content analysed to determine relevant material about the programme and their learning that would enrich the quantitative data.

Means for each section of the Student Evaluation of Teaching questionnaire were recalculated.

Results

(1) Approach: MANOVA results indicated that there was a main effect for Time ($F=3.490$, $p=0.021$). Univariate statistics showed a significant effect

for Time for
achieving motive ($F=10.486$, $p=0.004$) and for achieving strategy
($F=22.565$, $p=0.000$).

(2) Environment: MANOVA results for these variables
showed a significant effect for
Time ($F=8.200$, $P=0.001$). Univariate tests identified a significant
difference for
autonomy ($F=26.360$, $p=.000$).

(3) SOLO: Results of the Wilcoxon test indicated a significant
change in SOLO
category from the beginning to the end of semester ($z=-2.666$, $p=0.008$).
No student's
SOLO category changed to a less complex category, thirteen students'
categories
remained the same, however, nine students' categories increased.

(4) Conception: There was no significant change in levels of
conception of learning.
Four students' levels decreased, eight remained the same, and ten
increased.

(5) Evaluation of teaching: The mean for the six items representing
general teaching
characteristics was 4.46; the mean for selected items representing
teaching was 4.52; the
mean for assessment items was 4.36; and the mean for course material
items was 4.56.
The overall mean for the rating of the lecturer (on a 7-point scale)
was 6.14.

(6) Other incidental results: As stated earlier,
students' performances on their learning
contract assignment were assessed using a procedure based on the SOLO
taxonomy.
Twelve students' work was evaluated as being in the relational
category, nine as being in
the multistructural category, and one as being unistructural.

Similar to the significant change in SOLO category from the beginning
of semester to the
end of semester (evidenced in responses to open-ended questions on
learning), there was
significant change in pre-programme SOLO category and assessment SOLO
category.

Crosstabs were carried out to examine the joint distribution of
organization of knowledge
of learning (SOLO) and level of conception of learning (Conception).

The result for the pre-measures was not significant, however, that for the post-measures was significant ($\chi^2=4.28$, $df=1$, $p=0.038$). Results indicate that as Conception changed from reproductive to constructive, SOLO level increased (reproductive: SOLO level 3=5, SOLO level 4=0; constructive: SOLO level 3=8, SOLO level 4=9). The value of the

phi coefficient, which measures the extent of association between Conception and SOLO, is 0.45 which has an approximate significance of 0.034.

Discussion

The results reported above suggest that essentially the programme achieved what it set out to do. Although there was no significant change for surface and deep motives and strategies, there was significant decrease in achieving motive and strategy. That is, students were less competitive in their learning as a result of the learning experiences provided in the course. This most likely resulted from their learning activities in the collaborative learning groups. Overall, the predominant approach to learning was deep or transformative.

Evidence for students getting in touch with their ideas and beliefs relating to the teaching/learning process, evaluating these, and restructuring them when considered necessary, is provided by a consideration of their changes in conception of learning. Even though there was no significant change in pre- to post-conceptions for the class as a whole, that ten students' levels of conception increased and seventeen students reported having a "constructive" construction at the end of the programme, provide a strong message that the programme is operating satisfactorily in this regard. The relationship between students' level of conception of learning and organization of knowledge of learning suggests that teaching aimed deliberately at changing one of these constructs is likely to lead to a change in the other.

Support for improvement in the quality of learning through the development of relational understanding is supplied in a number of instances. Firstly, there was significant change during the programme in students' understanding of the complexity of the learning process, as evidenced in their responses to the open-ended questions. Secondly, evaluation of students' learning contract assignments at the end of semester placed twelve of them in the relational category of the SOLO taxonomy. Finally, when students' pre-programme responses to the open-ended questions are compared with their assignments at the end of the programme, there is significant change in SOLO category.

Student responses to the preferred and experienced environment measure indicate that for collaboration and responsibility "what they got was what they wanted". However, for autonomy, they reported experiencing more autonomy than they stated they preferred (at the beginning of the programme). The degree of autonomy provided is

confirmed by an examination of responses to two items (items 9 and 11, Table 1) in the student evaluation of teaching questionnaire. The means for these items are respectively 4.18 and 4.32, indicating students agreed that they were motivated to work independently and that they were allowed to develop their own perspectives on the material addressed.

Results from the student evaluation of teaching questionnaire suggest that students approved the approach to teaching; believed the material of the course was relevant and that they were helped in forming connections within it and with their previous knowledge; and the assessment items were suitable learning experiences.

Confirmation that the programme was useful in facilitating students' linking of declarative, procedural, and conditional knowledge of the teaching/learning process is provided by their practice teaching results for the year. Students are rated on a 7-point scale by their supervising teachers (7=outstanding, 1=very weak). Three

students

received a 7 (outstanding), fifteen a 6 (excellent), three a 4 (competent), and one student withdrew during the final practice school period.

Conclusion

Results reported in this study imply that the quality of learning outcomes may be improved through the provision of a learning environment characterized by learning activities and teaching strategies designed to promote student control of their own learning, constructivist approaches to learning, and relational understanding of material engaged. Increased complexity in structure of knowledge of the teaching/learning process also resulted from the teaching/learning strategies described in this program, and practice school teaching results provided evidence of how effectively students related declarative, procedural, and conditional knowledge of this process. That is, there is evidence of a positive relationship between conception of teaching, teaching approach, and student learning outcomes. Although there were no significant increases in the use of deep or transformative approaches to learning (they were initially high and remained so), the quality of learning outcomes, as well as the structure of knowledge of the teaching/learning process, and conceptions of learning of the students were reflective of those described in the literature as representative of students adopting a deep or transformative approach to their learning.

The learning environment as perceived by the students is one in which

the teacher

provides a high degree of autonomy, moderate opportunities for collaboration, and many opportunities to accept responsibility for one's own learning. As well, students perceived the assessment to be highly relevant, the teacher to have provided highly relevant material and facilitated relational understanding of it, and the teaching to have promoted a high degree of independence and positive interpersonal relationships. Although limited by the

items selected in the measures used in this study, the characteristics mentioned above provide powerful directions for developing learning environments for fostering meaningful learning.

In part, this program may be seen to directly address the plea of Trigwell and Prosser (1991b) that "Teachers need to explicitly help students focus on the structure of the course as a whole while it is being taught" (p. 274). The results indicate that if this is done, positive learning outcomes eventuate.

References

- Bain, J. (1994). Understanding by Learning or Learning by Understanding: How Shall We Teach? Inaugural lecture presented at Griffith University.
- Baird, J. (1991). Individual and Group reflection as a Basis for Teacher Development. In P. Hughes (Ed.). Teachers' Professional Development, Hawthorn, Vic. : ACER.
- Biggs, J. (1992). A Qualitative Approach to Grading Students. HERDSA News, 14(3),3-6.
- Biggs, J. and Moore, P. (1993). The Process of Learning, (3rd ed.), New York: Prentice Hall.
- Biggs, J. & Collis, K.F. (1982). Evaluating the Quality of Learning: The SOLO Taxonomy, New York: Academic Press.
- Boulton-Lewis, G. (1992). The SOLO Taxonomy and Levels of Knowledge of Learning. Research and Development in Higher Education, 15, 482-489.
- Boulton-Lewis, G. (in press). Tertiary Students' Knowledge of Their Own Learning and a SOLO Taxonomy. Higher Education.
- Boulton-Lewis, G. and Dart, B. C. (in press). Assessing Students' Knowledge of Learning: A Comparison of Data Collection Methods. In G. Gibbs (Ed.). Improving Student Learning: Theory and Practice, Oxford: OCSA.
- Brown, A. (1988). 'Motivation to Learn and Understand: On Taking Charge of One's Own Learning'. Cognition and Instruction, 5, 311-322.
- DART, B.C. (in press). A goal-mediational model of personal and

environmental influences on tertiary students' strategy use.

Higher Education.

Dart, B.C. (1994). Measuring Constructivist Learning Environments in Tertiary Education. Paper presented at the annual conference of the Australian Association for Research in Education, Newcastle.

Dart, B.C. and Clarke, J.A. (1991). Helping Students Become Better Learners: A Case Study in Teacher Education. *Higher Education*, 2, 317-335.

Dart, B.C. and Clarke, J.A. (1992). Learning and Learning Environments. Paper presented at the annual conference of the Higher Education Research and Development Society of Australasia, Churchill Campus, Monash University.

Entwistle, N. (1987). *Understanding Classroom Learning*, London: Hodder and Stoughton.

Entwistle, A. and Entwistle, N. (1992). Experiences of Understanding in Revising for Degree Examinations. *Learning and Instruction*, 2, 1-22.

Entwistle, N. and Entwistle, A. (1991). Contrasting Forms of Understanding for Degree Examinations: The Student Experience and its Implications. *Higher Education*, 22, 205-227.

Kember, D. and Gow, L. (1994). Orientations to Teaching and Their Effect on the Quality of Student Learning. *Journal of Higher Education*, 65(1), 58-74.

Knowles, M. (1986). *Using Learning Contracts*, San Francisco: Jossey-Bass.

Marton, F., Dall'Alba, G. & Beaty, E. (1993). Conceptions of Learning, *International Journal of Educational Research*, 19(3), 277-300.

Marton, F. and Salj, R. (1984). Approaches to Learning. In F. Marton, D. Hounsell, and N. Entwistle (Eds.). *The Experience of Learning*, Edinburgh: Scottish Academic Press.

Prawat, R. and Floden, R. (1994). Philosophical Perspectives on Constructivist Views of Learning. *Educational Psychology*, 29(1), 37-48.

Prosser, M., Trigwell, K., and Taylor, P. (1994). A Phenomenographic Study of Academics' Conceptions of Science Learning and Teaching.

Learning and Instruction,
4(3), 217-231.

Prosser, M. and Millar, R. (1989). The 'How' and 'What' of Learning Physics: A Phenomenographic Study. *European Journal of Psychology and Education*, 4, 513-528.

Ramsden, P. (1992). *Learning to Teach in Higher Education*. London: Routledge.

Ramsden, P. (1984). The Context of Learning. In F. Marton, D. Hounsell, and N. Entwistle (Eds.). *The Experience of Learning*, Edinburgh: Scottish Academic Press.

Ramsden, P. and Entwistle, N. (1981). Effects of Academic Departments on Students' Approaches to Studying. *British Journal of Educational Psychology*, 51, 367-383.

Resnick, L. (1987). Learning In School and Out. *Educational Researcher*. 16, 13-20.

Roby, T. (1988). Models of Discussion. In J. Dillon (Ed.). *Questioning and Discussion: A Multidisciplinary Study*, Norwood, NJ: Ablex.

Samuelowicz, K. and Bain, J. (1992). Conceptions of Teaching Held by Academic Teachers. *Higher Education*, 24, 93-111.

Tompkins, C. and McGraw, M-J. (1988). The Negotiated Learning Contract. In D. Boud (Ed.). *Developing Student Autonomy in Learning*, (2nd ed.), London: Kogan Page.

Trigwell, K. and Prosser, M. (1991). Improving the Quality of Student Learning: The Influence of Learning Context and Student Approaches to Learning on Learning Outcomes. *Higher Education*, 22, 251-266.

Trigwell, K. and Prosser, M. (1991). Relating Approaches to Study and Quality of Learning Outcomes at the Course Level. *British Journal of Educational Psychology*, 61, 265-275.

Van Rossum, E. and Schenck, S. (1984). The Relationship between Learning Conception, Study Strategy and Learning Outcome. *British Journal of Educational Psychology*, 54, 73-83.

Watkins, D. (1983). Depth of Processing and the Quality of Learning Outcomes. *Instructional Science*, 12, 49-58.

