WHAT IS LEARNED AT UNIVERSITY

SOMUL

The Social and Organisational Mediation of University Learning

Working Paper 4
February 2007

A cognitive-developmental model of university learning

This is the fourth in a series of working papers published by the Higher Education Academy to disseminate information about the project entitled *What is learned at university: the social and organisational mediation of university learning* (SOMUL).

This working paper describes the research instruments that have been used in the project to monitor changes in students' learning that occur while they are at university.

The project is part of the Economic and Social Research Council's Teaching and Learning Research Programme. It began in 2004 and will be completed at the end of 2007. The project is being undertaken jointly by a research team from the Centre for Higher Education Research and Information and the Institute of Educational Technology at the Open University, and the Centre for Research in Lifelong Learning at the University of Stirling.

The project is now entering its analysis and writing up stages. Several papers have already been presented at conferences and seminars. During the final year of the project, the implications for higher education policy and practice will be explored jointly with the Higher Education Academy and others.

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

T·L·R·P TEACHING & LEARNING RESEARCH PROGRAMME

The Higher Education Academy

Project aim and summary

The aim of the project is to:

- increase our understanding of the learning outcomes from an increasingly diverse higher education system
- investigate how these are socially and organisationally mediated. Social mediation refers primarily to the effects of the social mix of students and the characteristics of the student culture and lifestyle. Organisational mediation refers to the principles underlying the organisation of the curriculum and to linked organisational issues concerning staff, students, time and space.

In summary it is exploring the relationships between:

conceptions of learning outcomes:

- as cognitive development
- as academic and professional identity
- as personal identity and conception of self

and ways in which learning is mediated:

- by formal educational curricula and assessment
- by the principles of institutional organisation (curriculum, staff and students, space)
- by the social context of study

It focuses primarily on three subject fields, selected as representative of 'science', 'social science' and 'broadly vocational' courses:

- Biochemistry
- Business Studies
- Sociology

Relevance to policy and practice is being achieved through links with:

- The Higher Education Academy and the Subject Centres for:
  Biosciences
  Sociology, Anthropology and Politics
  Business, Management, Accountancy and Finance
- The Quality Assurance Agency for Higher Education
- The Council for Industry and Higher Education

Previous working papers in the series are:

Working Paper 1 – What is learned at university?
May 2005, John Brennan and David Jary

Working Paper 2 – The organisational mediation of university learning
December 2005, John Brennan and Mike Osborne

Working Paper 3 – The social mediation of university learning
October 2006, Muir Houston and Yann Lebeau

Future working papers will aim to disseminate the findings and explore the implications for policy and practice in higher education.

For more detailed information, including the project timetable and downloadable copies of other papers in this series, please visit the project website:

www.open.ac.uk/cheri/somulhome.htm

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A cognitive-developmental model of university learning

by John T.E. Richardson and Rob Edmunds

The previous working papers from the SOMUL project have been concerned primarily with its conceptual and theoretical basis. In this paper, we describe the instruments that are used in the project to monitor the changes in students' learning that occur while they are at university. There is already a well-established literature on the use of quantitative instruments to assess variations in students' learning (see Richardson, 2000, for a review), and where possible we adapted tried and tested questionnaires. Even when devising our own instruments, we were duly attentive to the various methodological issues that can arise (see Richardson, 2004).

In brief, the main SOMUL project involves a longitudinal study of first-year and final-year students studying Biosciences, Business Studies and Sociology at 15 different institutions by means of questionnaires, interviews and focus groups. The initial phase of the fieldwork yielded 635 completed questionnaires from the first-year students and 509 completed questionnaires from the final-year students. The questionnaires administered to the two cohorts of students shared four scales intended to measure the following:

- their conceptions of learning at university
- their approaches to studying at university
- their personal development since coming to university
- their personal change since coming to university.

Research instruments

Much research on the conceptions of learning held by students in higher education has been based on the analysis of interview transcripts following the principles of phenomenography. This is "a research method for mapping the qualitatively different ways in which people experience, conceptualize, perceive, and understand various aspects of, and phenomena in, the world around them" (Marton, 1986, p. 31; see also Marton, 1994). However, some researchers have tried to devise questionnaires whose subscales measure the extent to which students hold particular conceptions of learning. In the SOMUL project, we used 12 items taken from three subscales in the "Mental Models" section of Vermunt and van Rijswijk's (1988) Inventory of Learning Styles. These subscales were intended to measure the extent to which students considered that learning involved the active construction of knowledge, the passive intake of knowledge or the use of knowledge.

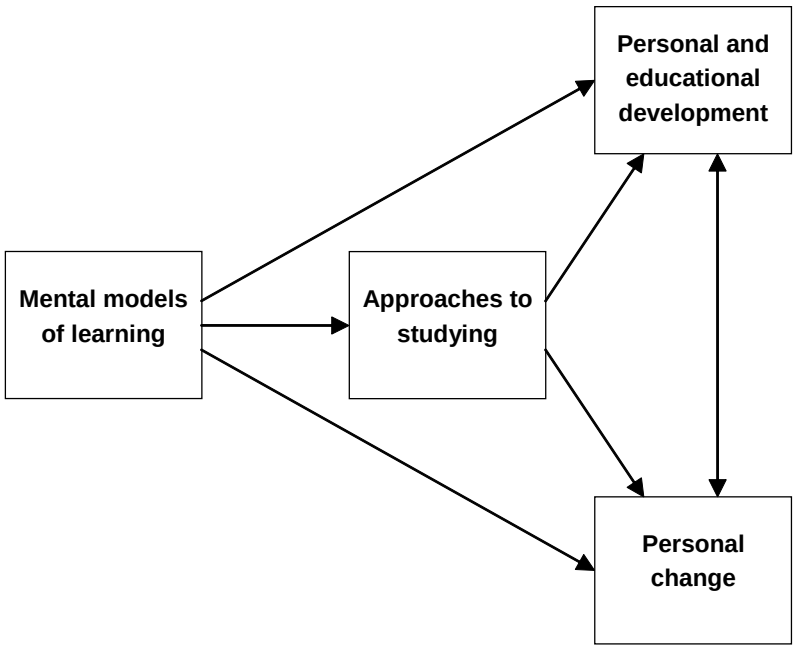
It is well established that students in higher education report using a number of distinctive approaches to studying, including a deep approach based on grasping the meaning of course materials and a surface approach based on memorising course materials for the purposes of assessment. Once again, these were initially identified by interviewing students about their normal study practices, but researchers have also tried to measure them using questionnaires (see Entwistle & McCune, 2004). In the SOMUL project, approaches to studying were measured using ten items from the Approaches to Learning and Studying scale

devised for use in the ESRC TLRP project on Enhancing Teaching–Learning Environments in Undergraduate Courses (ETL: at **www.ed.ac.uk/etl/publications.html**). These were intended to measure the extent to which students tended to adopt a deep approach or a surface approach to studying at university. The items were supplemented by two new items that were potentially relevant.

North American researchers have carried out investigations into the processes of intellectual development in higher education (e.g. Baxter Magolda, 1992; Belenky, Clinchy, Goldberger, & Tarule, 1986; Perry, 1970). Work in the United Kingdom has focused upon the acquisition of generic skills. In the SOMUL project, personal development was measured using 14 items from Lawless and Richardson's (2004) Personal and Educational Development Inventory. These were intended to measure the extent to which students felt that they were developing cognitive skills, mathematical skills, self-organisation and social skills. Once again, these 14 items were supplemented by two additional items that were potentially relevant. Even so, the SOMUL project team felt that there were other dimensions of personal change that should be considered, and so we also constructed an entirely new scale consisting of 12 items focusing on how students had changed as people since they entered higher education.

In the remainder of this working paper, we present empirical evidence for the reliability and validity of these four scales, as well as evidence for their interrelationships. Figure 1 shows a heuristic model to indicate how we think these different facets of learning and development are linked to one another. The arrows represent putative causal relationships, so that students' mental models of learning are assumed to affect their approaches to studying, and both their conceptions and their approaches potentially affect their personal development and personal change. The model is presented simply as a framework for validating the instruments that we have employed. It deliberately excludes the contextual factors (both academic and social) with which the SOMUL project is mainly concerned, which in principle can influence all of the components shown. Moreover, it provides only a snapshot of the links between learning and development at a particular point in the students' academic careers, and it excludes the feedback processes whereby personal development and change prompt students to modify their conceptions of learning and their approaches to studying over time.

Figure 1: heuristic model of learning and development in university students



Methods of data analysis

Concerns have been expressed about the adequacy of the questionnaires that have previously been used to investigate student learning in higher education (Coffield, Moseley, Hall, & Ecclestone, 2004). There are two fundamental requirements of these research instruments (Litwin, 2003). One is that they should be valid in the sense that they measure the personal qualities or traits that they purport to measure. One way to assess the validity of a questionnaire is to examine the relationship among the responses to its constituent items. This aspect of validity is known as construct validity and is usually addressed by means of factor analysis. This technique can provide evidence that the questionnaire measures one or more distinctive traits or constructs.

Accordingly, factor analysis was carried out on the participants' responses to each of the four instruments. For each instrument, the number of factors to extract was determined using the eigenvalues–one criterion, the scree test and the parallel analysis of 1,000 random correlation matrices using the program written by O'Connor (2000). Principal axis factoring was used to extract the relevant number of factors, and these were submitted to oblique rotation using a quartimin procedure in order to achieve simple structure. Loadings that were greater than 0.30 in absolute magnitude were regarded as being salient for the purposes of interpretation.

The other fundamental requirement of a questionnaire is that it should be reliable in the sense that it would yield consistent scores if used repeatedly under the same conditions with the same participants and is therefore relatively unaffected by errors of measurement. The items that yielded salient loadings on each factor were taken to define a factor-based subscale, and the respondents were assigned scores on each subscale by taking the average of the responses that they had given to its constituent items. The reliability of each subscale was estimated by Cronbach's (1951) coefficient alpha, which measures the internal consistency of a subscale by comparing the variance of the subscale scores with the variances of the responses to the constituent items. Finally, multiple regression analyses were carried out to investigate the relationships among the four instruments to examine the links hypothesised in Figure 1.

Conceptions of learning

A total of 1,107 students responded to all 12 items, and factor analysis yielded the solution shown in Table 1. The extracted factors broadly correspond to Vermunt and van Rijswijk's subscales measuring construction of knowledge, intake of knowledge and use of knowledge, respectively, except that Item 6 loaded more highly on the first factor than on the third factor. The three subscales yielded values of coefficient alpha of 0.68, 0.63 and 0.64, respectively, which would generally be regarded as adequate on conventional research-based criteria.

Table 1: Factor pattern matrix for "mental models" scale

	Factors		
	1	2	3
The topics that I learn need to be useful for solving practical problems (UK)	0.08	0.05	**0.40**
I like to be given precise instructions as to how to go about carrying out a task or doing an assignment (IK)	0.06	**0.60**	–0.02
For me, learning means trying to approach a problem from many different angles, including aspects that I hadn't previously thought of (CK)	**0.42**	–0.01	0.20
For me, learning is making sure that I can reproduce the facts presented in a course (IK)	0.08	0.29	0.11
I should try to look for connections within the subject matter without having to be told to do so (CK)	**0.78**	–0.03	–0.16
I should try to apply the theories dealt with in a course to practical situations (UK)	**0.49**	–0.01	0.20
If I have difficulty understanding a particular topic, I should consult other books without having to be told to do so (CK)	**0.61**	0.08	–0.08
Teachers should clearly explain what it is important for me to know and what is less important (IK)	–0.04	**0.59**	0.01
For me, learning means acquiring knowledge that I can use in everyday life (UK)	–0.08	0.04	**0.64**
I prefer teachers who tell me exactly what I need to know for an exam (IK)	–0.10	**0.72**	0.04
For me, learning means acquiring knowledge and skills that I can later put to practical use (UK)	0.05	0.00	**0.75**
I should try to think of particular examples of points made in the study materials without having to be told to do so (CK)	**0.50**	–0.07	0.17

Note: *loadings greater than 0.30 in absolute magnitude are shown in bold. The subscales from which the items were taken were: construction of knowledge (CK); intake of knowledge (IK); and use of knowledge (UK).*

Approaches to studying

A total of 1,111 students responded to all 12 items, and factor analysis yielded the solution shown in Table 2. The extracted factors correspond exactly to the ETL project's subscales measuring a deep approach and a surface approach, respectively. The two additional items (shown at the bottom of the table) added very little. The two subscales both yielded a value of coefficient alpha of 0.70, which would be regarded as satisfactory on conventional criteria.

Table 2: Factor pattern matrix for "approaches to studying" scale

	Factors	
	1	2
I often have trouble making sense of the things I have to learn (SA)	0.03	**0.68**
I usually set out to understand for myself the meaning of what I have to learn (DA)	**0.40**	–0.01
Much of what I learn seems no more than lots of unrelated bits and pieces in my mind (SA)	–0.01	**0.64**
In making sense of new ideas, I often relate them to practical or real-life contexts (DA)	**0.45**	–0.02
Ideas I've come across in my academic reading often set me off on long chains of thought (DA)	**0.55**	–0.08
I look at evidence carefully to reach my own conclusion about what I'm studying (DA)	**0.62**	–0.14
It's important for me to follow the argument or to see the reasons behind things (DA)	**0.54**	–0.10
I tend to take what I've been taught at face value without questioning it much (SA)	–0.21	**0.43**
In reading course material, I try to find out for myself exactly what the author means (DA)	**0.51**	–0.12
I just go through the motions of studying without seeing where I'm going (SA)	–0.24	**0.59**
Working things through with other students is really useful	0.15	0.14
I wish I'd had time to read more books	**0.30**	0.10

Note: *loadings greater than 0.30 in absolute magnitude are shown in bold. The subscales from which the items were taken were: deep approach (DA); and surface approach (SA).*

Associations among the four scales were analysed using multivariate analysis of covariance. These used the two cohorts (first years versus final years) and 15 institutions as independent variables, the scores on one scale as covariates (or predictors) and the scores on another scale as dependent variables. The associations were measured between pairs of scales within the 30 (15 × 2) cells, thus controlling for any variation between the cohorts or across the institutions.

The appropriate index of association is the complement of Wilks' Λ (lambda). The quantity $(1 - \Lambda)$ is the multivariate generalisation of the univariate coefficient of determination, r^2, and it measures the proportion of the variation in the dependent variables that is explained by the predictor variables (see Cohen, Cohen, West, & Aiken, 2003, p. 611).

The students' scores on the mental models subscales explained 37% of the variation in their scores on the approaches to studying subscales. Table 3 shows the standardised regression coefficients between the two sets of scores.

- Those students who regarded learning as the construction of knowledge or as the use of knowledge were more likely to adopt a deep approach and less likely to adopt a surface approach.
- Those students who regarded learning as the intake of knowledge were more likely to adopt a surface approach and less likely to adopt a deep approach.

These results confirm Vermunt's (1998) claim that students' mental models of learning are a primary determinant of their approaches to studying. In particular, those students who have a reconstructive conception of learning are more likely to adopt a deep approach, whereas those who have a reproductive conception of learning are more likely to adopt a surface approach.

Table 3: Standardised regression coefficients relating mental models and approaches to studying

	Dependent variable	
Predictor variable	**Deep**	**Surface**
Construction of knowledge	0.40*	–0.29*
Intake of knowledge	–0.16*	0.34*
Use of knowledge	0.21*	–0.01

* $p < 0.05$

Personal and educational development

The final item in this scale invited students to nominate other capabilities they had acquired at university, but fewer than 16% of the students did so. This suggests that the 15 remaining items provided a satisfactory coverage of the relevant domain. A total of 1,106 students responded to the 15 items, and factor analysis yielded the solution shown in Table 4. The extracted factors broadly correspond to Lawless and Richardson's subscales measuring self-organisation, mathematical skills, social skills and cognitive skills respectively, except that the item relating to computer literacy loaded more highly on the third factor

Table 4: Factor pattern loadings for "personal and educational development" scale

	Factors			
	1	**2**	**3**	**4**
Ability to analyse numerical data (MS)	–0.02	**0.87**	0.05	0.01
Ability to apply knowledge (CS)	0.14	0.17	–0.02	**0.50**
Ability to use numerical data (MS)	–0.01	**0.87**	0.03	–0.02
Ability to work in teams (SS)	–0.01	0.12	**0.62**	–0.01
Computer literacy (MS)	–0.01	0.09	**0.48**	0.06
Critical analysis (CS)	–0.11	–0.03	0.09	**0.81**
Evaluation skills (CS)	–0.07	–0.05	0.09	**0.80**
Interpersonal skills (SS)	0.08	–0.05	**0.67**	0.06
Leadership skills (SS)	–0.02	–0.04	**0.82**	–0.08
Oral presentation skills (SS)	0.04	–0.03	**0.56**	0.05
Self-discipline (SOS)	**0.85**	–0.04	0.07	–0.05
Self-reliance (SOS)	**0.78**	0.03	0.04	–0.04
Time management (SOS)	**0.72**	0.01	0.00	0.05
Writing skills (CS)	**0.32**	–0.09	0.12	**0.35**
A real expertise in my subject	0.21	0.06	–0.07	**0.31**

Note: *loadings greater than 0.30 in absolute magnitude are shown in bold. The subscales from which the items were taken were: cognitive skills (CS); mathematical skills (MS); self-organisation skills (SOS); and social skills (SS).*

than on the second factor. This suggests that contemporary students regard computers as means of social communication rather than as mathematical devices. The other additional item showed only low loadings, but its highest loading was on the factor concerned with cognitive skills. It was therefore added to the items defining the cognitive skills subscale, and the item concerned with computer literacy was moved from the mathematical skills subscale to the social skills subscale. The four revised subscales yielded values of coefficient alpha of 0.84, 0.87, 0.78 and 0.75, respectively, which would be regarded as satisfactory on conventional criteria.

The students' scores on the mental models subscales explained 14% of the variation in their scores on personal and educational development; their scores on the approaches to studying scales explained 12% of the variation in their scores on personal and educational development; and their scores on the mental models subscales and the approaches to studying subscales taken together explained 18% of the variation in their scores on personal and educational development. Table 5 shows the standardised regression coefficients from the latter analysis.

- Those students who regard learning as the construction of knowledge and who adopt a deep rather than a surface approach report greater development of their cognitive skills.
- Those students who regard learning as the use of knowledge and who tend not to adopt a surface approach report greater development of their mathematical skills.
- Those students who regard learning as the construction of knowledge and who tend not to adopt a surface approach report greater development of their self-organisation skills.
- Those students who regard learning as either the construction of knowledge or the use of knowledge report greater development of their social skills.

Nevertheless, it should be noted that the observed relationships were relatively weak and only obtained statistical significance by virtue of the large sample size.

Table 5: Standardised regression coefficients relating mental models, approaches to studying and personal and educational development

	Dependent variable (Personal and educational development)			
Predictor variable	**Cognitive**	**Mathematical**	**Self-organisation**	**Social**
Construction of knowledge	0.20*	0.06	0.15*	0.09*
Intake of knowledge	0.04	–0.04	0.06	0.03
Use of knowledge	0.02	0.14*	0.05	0.08*
Deep approach	0.14*	0.03	0.03	0.04
Surface approach	–0.15*	–0.08*	–0.08*	–0.06

* $p < 0.05$

Personal change

The final item in this scale invited students to nominate other ways in which they had changed since coming to university, but fewer than 13% of the students did so. Once again, this suggests that the remaining 11 items provided a satisfactory coverage of the relevant domain. A total of 1,102 students responded to the 11 items, and factor analysis yielded the solution shown in Table 6. The four items that showed salient loadings on the first factor measure social change (or the lack of it); Item 5 and the complements of the other three items were taken to define a factor-based subscale of social change. The four items that showed salient loadings on the second scale measure an increase in personal confidence, and these items were taken to define a factor-based subscale of confidence. The three items that showed salient loadings only on the third factor measure academic change; these three items were taken to define a factor-based subscale of academic change. The three subscales yielded values of coefficient alpha of 0.67, 0.68 and 0.48, respectively. The first two values would be regarded as adequate on conventional research-based criteria, but the last value would not.

Table 6: Factor pattern matrix for "personal change" scale

	Factors		
	1	2	3
I now have a much clearer view of what I want to do in the future	–0.13	**0.37**	0.28
I am a much more self-confident person than the person I was when I came here	0.17	**0.58**	0.06
I feel that I no longer have much in common with my friends outside of university	0.05	–0.01	**0.30**
I am very committed to the subjects I've studied here and would like somehow to continue to read/study them in the future	–0.09	0.05	**0.67**
I can't imagine losing touch with some of the friends I've made here	**0.56**	0.15	0.00
I would like to remain associated with the university in some way	0.21	0.06	**0.49**
My time at university has really changed the way I see the world	0.23	**0.40**	0.26
My life outside the university remains the most important to me	**–0.47**	0.22	**–0.32**
I feel that I am now able to get on with a much wider range of people	0.16	**0.69**	–0.10
I don't really fit in here. I'll be quite glad to leave	**–0.53**	–0.08	0.07
The qualification is the main thing. University has not changed me that much	**–0.64**	–0.09	–0.06

Note: *loadings greater than 0.30 in absolute magnitude are shown in bold.*

The model shown in Figure 1 includes the possibility of an interrelationship between personal and educational development and personal change (indicated by the double-headed arrow). This hypothesis was supported by the fact that the students' scores on the three subscales that constituted personal change shared 20% of their variation with the students' scores on the four subscales that constituted personal and educational development. However, an apparent relationship of this sort might be wholly spurious if the two sets of variables share a common cause: that is, there is a third variable (or set of variables) that brings about variation in each of the

first two sets of variables, and there is no genuine interrelationship between the latter. In the present case, the apparent relationship between personal and educational development and personal change may be spurious, since the students' scores on personal and educational development and their scores on personal change share possible common causes in their conceptions of learning and their approaches to studying.

A separate point is that, in any case, even the apparent relationship between their scores on the personal and educational development scale and their scores on the personal change scale is by no means a strong one. In other words, there seems to be relatively little overlap in the aspects of personal change and development at university that these instruments are tapping. Both instruments seem to be necessary to provide a clear picture of the students' experience.

The students' scores on the mental models subscales explained 8% of the variation in their scores on the personal change subscales; their scores on the approaches to studying subscales explained 11% of the variation in their scores on the personal change subscales; and their scores on the mental models subscales and the approaches to studying subscales together explained 14% of the variation in their scores on the personal change subscales. Table 7 shows the standardised regression coefficients from the latter analysis.

- Those students who tend not to adopt a surface approach report a greater degree of social change.
- Those students who regard learning as either the construction of knowledge or the use of knowledge report a greater increase in their personal confidence.
- Those students who regard learning as the use of knowledge and who adopt a deep approach report a greater degree of academic change.

Once again, however, it should be noted that the observed relationships were relatively weak and only obtained statistical significance by virtue of the large sample size.

Table 7: Standardised regression coefficients relating mental models, approaches to studying and personal change

	Dependent variable (Personal change)		
Predictor variable	**Social change**	**Confidence**	**Academic change**
Construction of knowledge	0.02	0.09*	0.03
Intake of knowledge	–0.03	0.04	–0.04
Use of knowledge	0.00	0.13*	0.09*
Deep approach	–0.04	0.04	0.14*
Surface approach	–0.20*	–0.01	–0.04

* $p < 0.05$

Conclusions

This working paper has reported evidence concerning the four scales that were administered to both first-year students and final-year students in the initial phase of the SOMUL project. The application of factor analysis broadly confirmed the construct validity of the four scales. Even the wholly new fourth scale seemed to be measuring three distinct aspects of personal change, and these seemed to complement rather than duplicate the four subscales of Lawless and Richardson's (2004) inventory on personal and educational development. Apart from one of the subscales concerned with personal change, the various dimensions measured by these four scales showed at least adequate reliability as estimated by Cronbach's coefficient alpha.

The interrelationships among the four scales were consistent with the heuristic model shown in Figure 1. There was a clear association between the students' conceptions of learning and their approaches to studying, and both of these scales predicted their scores on personal and educational development and their scores on personal change. The relationships between, on the one hand, a reconstructive conception of learning and a deep approach to studying and, on the other hand, a reproductive conception of learning and a surface approach to studying are sufficiently strong to support Vermunt's (2005) position that these constitute distinct learning 'patterns' or learning 'styles'.

Nevertheless, the relationships between these learning patterns and students' personal change and development at university are remarkably weak. This is of particular relevance to the SOMUL project, because it suggests that students' personal change and development are primarily the result *not* of the learning patterns that they bring to their studies but of their varied experiences while they are at university. The aim of the SOMUL project is to assess the influence of their choice of subject and their choice of institution on these outcomes. This working paper has shown that the initial and follow-up surveys will provide a sound basis for comparing different cohorts of students taking different subjects at different institutions.

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References

Baxter Magolda, M.B. (1992). *Knowing and Reasoning in College: Gender-Related Patterns in Students' Intellectual Development*. San Francisco: Jossey-Bass.

Belenky, M.F., Clinchy, B.M., Goldberger, N.R., & Tarule, J.M. (1986). *Women's Ways of Knowing: The Development of Self, Voice, and Mind*. New York: Basic Books.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning Styles and Pedagogy in Post-16 Learning: A Systematic and Critical Review*. London: Learning and Skills Research Centre.

Cohen, J., Cohen, P., West, S.G., & Aiken, L.S. (2003). *Applied Multiple Regression/Correlation for the Behavioral Sciences* (3rd ed.). Mahwah, NJ: Erlbaum.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Multivariate Behavioral Research*, *16*, 297–334.

Entwistle, N., & McCune, V. (2004). The conceptual bases of study strategy inventories. *Educational Psychology Review*, *16*, 325–345.

Lawless, C.J., & Richardson, J.T.E. (2004). Monitoring the experiences of graduates in distance education. *Studies in Higher Education*, *29*, 353–374.

Litwin, M.S. (2003). *How to Assess and Interpret Survey Psychometrics* (2nd ed.). Thousand Oaks, CA: Sage.

Marton, F. (1986). Phenomenography: A research approach to investigating different understandings of reality. *Journal of Thought*, *21*(3), 28–49.

Marton, F. (1994). Phenomenography. In T.Husén & T.N. Postlethwaite (Eds.), *The International Encyclopedia of Education* (2nd ed., Vol. 8, pp. 4424–4429). Oxford: Pergamon Press.

O'Connor, B.P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behaviour Research Methods, Instruments, and Computers*, *32*, 396–402.

Perry, W.P., Jr. (1970). *Forms of Intellectual and Ethical Development in the College Years: A Scheme*. New York: Holt, Rinehart, & Winston.

Richardson, J.T.E. (2000). *Researching Student Learning: Approaches to Studying in Campus-Based and Distance Education*. Buckingham: Open University Press.

Richardson, J.T.E. (2004). Methodological issues in questionnaire-based research on student learning in higher education. *Educational Psychology Review*, *16*, 347-358.

Vermunt, J.D. (1998). The regulation of constructive learning processes. *British Journal of Educational Psychology*, *68*, 149–171.

Vermunt, J.D. (2005). Relations between student learning patterns and personal and contextual factors and academic performance. *Higher Education*, *49*, 205–234.

Vermunt, J.D.H.M., & van Rijswijk, F.A.W.M. (1988). Analysis and development of students' skill in selfregulated learning. *Higher Education*, *17*, 647–682.

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