In Chapter 8, I mentioned that the SPQ and the ASI were developed for use in investigations into student learning in campus-based institutions of higher education and were not specifically intended to characterize students who were taking courses in distance education. In contrast, the DESP inventory was designed to measure relevant characteristics of distance-learning students. Nevertheless, the subscales in the DESP inventory concerned with approaches to studying were simply borrowed from the existing ASI with minor alterations to their wording to render them suitable for use in a distance-learning context. In this regard, the DESP inventory was essentially parasitic upon research tools that had been designed to measure approaches to studying in campus-based students.

A different research strategy was adopted by Vermunt and van Rijswijk (1988), who set out to develop a valid, reliable and usable instrument that would measure differences in approaches to learning among students taking courses for the first time with the Dutch Open University. This institution delivers courses primarily through specially prepared correspondence materials with tutorial support available at regional study centres. In developing their instrument, Vermunt and van Rijswijk built on the results of a qualitative investigation in which first-year students who had recently embarked on courses with the Dutch Open University were interviewed about their approaches, conceptions and orientations towards studying. As explained in detail in Chapter 4, Vermunt and van Rijswijk distinguished between: (a) the processing activities used by students to learn specific materials; and (b) the regulation activities used by students to coordinate their own processing activities. In addition, whether and how students are able to regulate their own learning activities depends upon their conceptions (or 'mental models') of learning and upon their motivation or orientation towards their studies (see also Vermunt 1996).
The 144-item version of the Inventory of Learning Styles

On the basis of the different comments made by their interviewees, Vermunt and van Rijswijk (1988) assembled a list of 241 statements concerning study activities, motives and conceptions to construct a new instrument, the Inventory of Learning Styles (ILS). The first section of this instrument was concerned with the study activities involved in the processing of course content (50 items) and the regulation of learning (50 items). For each item, respondents were instructed to indicate how often they engaged in the relevant study activity using a five-point scale from 'I seldom or never do this', scoring 1, to 'I (almost) always do this', scoring 5. The second section was concerned with study orientations (50 items) and with students’ conceptions of learning, education and cooperation (91 items). Here, respondents were instructed to indicate the extent of their agreement or disagreement with each listed motive or attitude using a five-point scale from 'totally disagree', scoring 1, to 'totally agree', scoring 5. Responses were obtained from a total of 211 students who had taken at least one course with the Dutch Open University.

Vermunt and van Rijswijk used factor analysis to identify those items that were most strongly associated with each of the four components of the ILS (processing, regulation, orientations and conceptions). On the basis of the results, they constructed a revised version of their instrument, which contained just 144 items in 16 subscales, grouped in turn under four main scales. These scales and subscales are listed in Box 9.1. Vermunt and van Rijswijk then calculated the scores obtained by their respondents on these 16 subscales and carried out a further factor analysis on these scores. This yielded four independent factors:

- One factor showed positive loadings on the subscales concerned with self-regulation, the construction of knowledge, a deep approach, an elaborative approach and a personally interested orientation. This was taken to represent a self-regulated and 'meaning directed' learning style.
- A second factor showed positive loadings on the subscales that were concerned with external regulation, the intake of knowledge, a surface approach, a certificate directed orientation and a self-test directed orientation. This was taken to represent an externally regulated and 'reproduction directed' learning style.
- A third factor showed positive loadings on the subscales concerned with a vocation directed orientation, the use of knowledge, an elaborative approach and a certificate directed orientation, together with a negative loading on the subscale concerned with a personally interested orientation. This was taken to represent an 'application directed' learning style.
- The fourth factor showed positive loadings on the subscales concerned with a lack of regulation, an ambivalent orientation, cooperation and a
Box 9.1 Subscales contained in the 144-item version of the Inventory of Learning Styles

Processing of subject matter
Surface approach (12 items)
Deep approach (12 items)
Elaborative approach (6 items)

Regulation of learning
External regulation (12 items)
Self-regulation (12 items)
Lack of regulation (6 items)

Study orientations
Certificate directed (6 items)
Self-test directed (6 items)
Vocation directed (6 items)
Personally interested (6 items)
Ambivalent (6 items)

Conceptions of learning, education and cooperation
Intake of knowledge (12 items)
Construction of knowledge (12 items)
Use of knowledge (6 items)
Stimulating education (12 items)
Cooperation (12 items)

Source: Vermunt and van Rijswijk 1988: 661, 663

stimulating education. This was taken to represent an unregulated or 'problematic' learning style.

In Chapter 4, I described the four qualitatively different learning 'styles' that Vermunt (1996) arrived at on the basis of the accounts given by campus-based and distance-learning students in structured interviews (see, in particular, Box 4.2, p. 58). The detailed specification of the four learning styles is remarkably close to the composition and interpretation of the four factors obtained by Vermunt and van Rijswijk on the basis of the responses given by distance-learning students to the ILS. This is an excellent example of 'triangulation' in educational and social research: that is, the crossvalidation of one's findings by the use of both quantitative and qualitative methods.

Vermunt and van Rijswijk went on to examine the relationship between their students' scores on these 16 subscales and their educational experience. First, the respondents were divided into those who had already completed a
course in higher education before studying with the Dutch Open University and those who had not. Those students who had previous experience of higher education obtained lower scores on the subscales that were concerned with a self-test directed orientation, the intake of knowledge, a certificate directed orientation, external regulation and a lack of regulation. In other words, they were less likely to exhibit an externally regulated and reproduction directed learning style than those students with no previous experience of higher education. This is consistent with the proposal by Säljö (1979a, b), which was mentioned in Chapter 3, that learning may become ‘thematic’ in the light of experience of higher education.

Next, Vermunt and van Rijswijk identified amongst their respondents those who had relatively little experience of studying with the Dutch Open University (at most 50 hours of study time), and those who had studied more than two complete units (typically representing at least 200 hours of study time). The more experienced students obtained higher scores on the subscales that were concerned with a certificate directed orientation, a vocation directed orientation and external regulation but lower scores on the subscales that were concerned with an ambivalent orientation, a lack of regulation, an elaborative approach and cooperation. In other words, although the more experienced students were less likely to exhibit an unregulated or problematic learning style, they were also more likely to exhibit an externally regulated and reproduction directed learning style than students with less experience of the Open University.

Of course, groups of students with more or less experience of studying in distance education may differ on a number of other variables that might in principle influence their approaches to studying and hence their responses to instruments such as the ILS. Thus, these latter conclusions need to be interpreted with some caution as they were based upon simple pairwise comparisons that failed to control for the confounded effects of other variables. Nevertheless, they indicate that the Dutch Open University was conspicuously unsuccessful in fostering more appropriate approaches and orientations to studying on the part of its students. In this respect, it is far from unique: in Chapter 5 I mentioned that a very similar observation had been made with respect to campus-based institutions on the basis of the findings of research using the SPQ (Biggs 1987; Gow and Kember 1990; Volet et al. 1994). However, in Chapter 6, I cited evidence obtained using different versions of the ASI, which suggested that this trend was not observed at the Open University in the UK (Richardson et al. 1999) and that it could be avoided and even reversed by the introduction of a problem-based curriculum (Coles 1985; Newble and Clarke 1986, 1987).

The 120-item version of the ILS

Another difficulty in interpreting the findings obtained by Vermunt and van Rijswijk is that they did not include in their study any comparison
group of campus-based students. This was remedied in a subsequent investigation by Vermunt (1998), who obtained responses to the 144-item version of the ILS from a further 443 students at the Dutch Open University. Vermunt then pooled these with the responses produced by the 211 students who had participated in the original study by Vermunt and van Rijswijk. From the 654 sets of responses, Vermunt devised a revised version of the ILS that contained just 120 items in 20 subscales. There is currently no published source for either this or the earlier versions of the ILS, but copies of the 120-item version in Dutch or English together with a scoring guide can be obtained from the author: Professor Jan Vermunt, Department of Educational Research and Development, Maastricht University, P.O. Box 616, 6200 MS Maastricht, The Netherlands.

Vermunt and van Rijswijk (1988) had used the 144-item version of the ILS as the basis for a self-instructional package designed to help distance-learning students develop their learning skills and their conceptions of learning. Vermunt (1995) extended this package, incorporating the 120-item version of the ILS. It was then evaluated in a cohort of psychology students who had enrolled at a campus-based university in the Netherlands. In the course of this evaluation, Vermunt compared the students' subscale scores on the ILS with those of other students who had used the package in the course of their studies with the Dutch Open University. He found that the two groups differed significantly in their scores on eight of the subscales:

- The distance-learning students tended to obtain higher scores than the campus-based students on the subscales concerned with the analytic processing strategy, the external regulation strategy directed at learning processes and the personally interested learning orientation.
- The campus-based students tended to obtain higher scores than the distance-learning students on the subscales concerned with memorizing and rehearsing, a lack of regulation, the mental model or conception devoted to stimulating education, the mental model or conception devoted to cooperative learning, and the vocational learning orientation.

Vermunt concluded that in general the campus-based students were more likely to exhibit an undirected learning style than the distance-learning students. It is, however, difficult to give a clear interpretation of these findings. Vermunt noted that the campus-based students and the distance-learning students were different both in their mean ages (25.1 years and 34.0 years, respectively) and in their gender distribution (67 per cent women versus 33 per cent women, respectively). More important, the two groups had also been exposed to different versions of the self-instructional package and the campus-based students had additionally received two tutorials at which the contents of the package had been discussed. Although the campus-based students rated their programme more favourably than did the distance-learning students, one possibility is that the extended programme tended to undermine their existing learning styles.
Table 9.1 Mean scores obtained on the 120-item version of the Inventory of Learning Styles by distance-learning and campus-based students

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Distance learning</th>
<th>Campus based</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing strategies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep processing: relating and structuring</td>
<td>3.56</td>
<td>3.36</td>
<td>+0.17**</td>
</tr>
<tr>
<td>Deep processing: critical processing</td>
<td>3.16</td>
<td>2.81</td>
<td>+0.28**</td>
</tr>
<tr>
<td>Stepwise processing: memorizing and rehearsing</td>
<td>2.63</td>
<td>2.83</td>
<td>−0.15**</td>
</tr>
<tr>
<td>Stepwise processing: analysing</td>
<td>2.92</td>
<td>2.73</td>
<td>+0.16**</td>
</tr>
<tr>
<td>Concrete processing</td>
<td>3.03</td>
<td>2.81</td>
<td>+0.18**</td>
</tr>
<tr>
<td><strong>Regulation strategies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-regulation: learning process and results</td>
<td>2.45</td>
<td>2.54</td>
<td>−0.07</td>
</tr>
<tr>
<td>Self-regulation: learning content</td>
<td>2.50</td>
<td>1.87</td>
<td>+0.54**</td>
</tr>
<tr>
<td>External regulation: learning process</td>
<td>3.45</td>
<td>3.08</td>
<td>+0.29**</td>
</tr>
<tr>
<td>External regulation: learning results</td>
<td>3.51</td>
<td>3.38</td>
<td>+0.10*</td>
</tr>
<tr>
<td>Lack of regulation</td>
<td>2.15</td>
<td>2.40</td>
<td>−0.21**</td>
</tr>
<tr>
<td><strong>Mental models of learning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction of knowledge</td>
<td>3.69</td>
<td>3.52</td>
<td>+0.17**</td>
</tr>
<tr>
<td>Intake of knowledge</td>
<td>3.47</td>
<td>3.53</td>
<td>−0.05</td>
</tr>
<tr>
<td>Use of knowledge</td>
<td>3.75</td>
<td>3.91</td>
<td>−0.16**</td>
</tr>
<tr>
<td>Stimulating education</td>
<td>2.85</td>
<td>3.13</td>
<td>−0.23**</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>2.25</td>
<td>3.01</td>
<td>−0.63**</td>
</tr>
<tr>
<td><strong>Learning orientations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personally interested</td>
<td>3.69</td>
<td>3.17</td>
<td>+0.47**</td>
</tr>
<tr>
<td>Certificate oriented</td>
<td>3.09</td>
<td>3.28</td>
<td>−0.15**</td>
</tr>
<tr>
<td>Self-test oriented</td>
<td>2.59</td>
<td>2.83</td>
<td>−0.18**</td>
</tr>
<tr>
<td>Vocation oriented</td>
<td>3.11</td>
<td>3.79</td>
<td>−0.54**</td>
</tr>
<tr>
<td>Ambivalent</td>
<td>1.75</td>
<td>2.07</td>
<td>−0.30**</td>
</tr>
</tbody>
</table>

Source: Vermunt 1998: 161

*p < 0.05, two-tailed test; **p < 0.005, two-tailed test

Vermunt (1998) then administered the 120-item version of the ILS to first-year students drawn from all of the subject areas taught at a campus-based university in the Netherlands, with minor changes in wording to render certain items appropriate for campus-based students. Table 9.1 shows the mean scores obtained on the 20 subscales by the 654 distance-learning students and by 795 campus-based students. From the information provided in Vermunt’s article, I compared the two sets of data using two-tailed Student’s t tests; the comparisons that are statistically significant at the 5 per cent level are indicated in Table 9.1 by asterisks. However, as mentioned in Chapter 6, Harper and Kember (1986) argued that a more stringent significance level should be used to guard against the increased probability of making Type I errors (that is, of obtaining spuriously significant
results) when carrying out large numbers of independent statistical tests. Consequently, those comparisons that are significant using the more stringent criterion of 0.5 per cent are indicated by two asterisks. There are significant differences between the groups on 18 of the 20 subscales, and 17 of the differences remain significant at this more stringent level.

A separate issue is that comparisons may be statistically significant and yet be of little practical importance, which is especially likely if the groups in question are very large. This issue can be addressed by deriving a measure of the size of the relevant effect (see Richardson 1996). When two separate groups are being compared, the most common measure of effect size is computed by standardizing the difference between their respective means against the pooled within-group standard deviation; thus, an effect size of 0.5 means that the two groups differ on average by an amount equal to one-half of their standard deviation. The standardized mean difference obtained from two samples is known to overestimate the standardized mean difference in the populations from which the samples have been drawn. However, the former can be adjusted by multiplying it by a simple correction factor and the bias is quite small with very large samples (Hedges and Olkin 1985: 76–85). Table 9.1 shows the standardized mean differences for the 20 subscales of the ILS, corrected for sampling bias. Any effect sizes that are smaller than 0.2 in their absolute magnitude might in principle be dismissed as being of little practical importance (Cohen 1969: 22–4) but this still leaves nine differences that represent effect sizes larger than this.

Vermunt went on to confirm that the internal consistency and the test–retest reliability of each of the 20 subscales were broadly satisfactory. Factor analyses that were carried out separately on the scores obtained by the campus-based students and the distance-learning students led to solutions that were very similar to each other. As in Vermunt and van Rijswijk’s (1988) earlier study, there were four factors representing styles of learning that were described as meaning directed, reproduction directed, application directed and undirected. In general, the distance-learning students tended to obtain higher scores than the campus-based students on the subscales that were associated with a meaning directed learning style, but they tended to obtain lower scores than the campus-based students on the subscales that were associated with an application directed learning style and an undirected learning style. The differences on the subscales associated with a reproduction directed learning style were inconsistent in direction.

These findings suggest that students in distance education exhibit learning styles that are more desirable than those shown by campus-based students, in the sense that they are more consistent with the avowed aims of institutions of higher education. Nevertheless, one should be cautious about drawing the inference that these differences in learning style are actually the consequence of differences in the mode of course delivery. As always, one must remember the demographic differences that exist between campus-based and distance-learning students and which may, in principle, lead to differences in their approaches to studying. In the case of Vermunt's
(1998) study, an obvious confounded variable was that of the participants' ages: the average age of the distance-learning students was 36.5 years, whereas that of the campus-based students was only 22.5 years (Vermunt, personal communication, November 10, 1997).

As I mentioned in Chapter 4, Gibbs et al. (1984) claimed on the basis of interview data that an intrinsic or personal orientation was common both in distance-learning students and in older campus-based students. Thus, the apparent difference in learning styles obtained by Vermunt might have been due to the fact that the distance-learning students in his study were older than the campus-based students. However, Vermunt and van Rijswijk (1988) had examined the role of age as a predictor of scores on the ILS and their findings do not support this interpretation:

- The ages of the 211 participants varied between 20 and 75 years, and so their study should have been able to detect any effects of practical importance. Nevertheless, age did not show a statistically significant correlation with their scores on four of the five subscales measuring a meaning directed learning style, and there was only a weak positive relationship with their scores on the fifth subscale. It is therefore implausible that the tendency for distance-learning students to obtain higher scores than campus-based students on the subscales measuring this learning style could be due to confounded differences in age.

- Conversely, Vermunt and van Rijswijk found that there was a significant positive correlation between age and the scores on three of the five subscales measuring a reproduction directed learning style, yet there was no consistent pattern of differences between campus-based and distance-learning students on the subscales measuring this learning style. If distance-learning students were more likely to exhibit a meaning directed learning style just because they were older, why were they not more likely to exhibit a reproduction directed learning style, too?

- Vermunt and van Rijswijk found that there was a statistically significant negative correlation between age and the scores on four of the five subscales measuring an application directed learning style. Vermunt found, correspondingly, that distance-learning students obtained lower scores than campus-based students on the subscales measuring this learning style. In this case, the apparent differences between campus-based and distance-learning students in their subscale scores could in principle be ascribed to the confounded difference in their age.

- Finally, Vermunt and van Rijswijk found no significant relationship between age and their participants' scores on three of the four subscales measuring an undirected learning style; there was a weak positive relationship with their scores on the fourth subscale. In other words, older students are, if anything, more likely to exhibit this style than younger students. Nevertheless, the (older) distance-learning students actually tended to obtain lower scores than the (younger) campus-based students on the subscales measuring this learning style.
Finally, Vermunt showed that, in both groups of students, their scores on the five subscales measuring different regulation strategies could be predicted by their scores on the subscales measuring different mental models of learning and different learning orientations. Moreover, their scores on the five subscales measuring different processing strategies could be predicted by their scores on the subscales measuring different regulation strategies, mental models and learning orientations. These findings were taken as evidence for Vermunt and van Rijswijk's original assumption that the influence of students' mental models and learning orientations on their processing strategies was largely mediated by their use of different regulation strategies (Figure 9.1). The general pattern of predictive relationships was similar in these two groups of students and this implies that the findings are highly generalizable between campus-based education and distance education.

Further research in campus-based education

Lonka and Lindblom-Ylänne (1996) constructed a composite instrument containing open-ended questions and items from a number of previous inventories:

- the 14 items constituting the subscales of the ASI concerned with deep approach, surface approach and achievement motivation (see Chapter 6);
- 50 items selected from the subscales of the 144-item version of the ILS concerned with the regulation of learning (external regulation, self-regulation and lack of regulation) and with conceptions of learning, education and cooperation (intake of knowledge, construction of knowledge, use of knowledge, stimulating education and cooperation);
seven items selected by Ryan (1984) from the Checklist of Educational Views (CLEV), which had been designed by Perry et al. (1968) to measure adherence to dualist ways of thinking in the scheme that was subsequently described by Perry (1970) and discussed in Chapter 3.

Lonka and Lindblom-Ylänne administered this instrument to students in their first or final year of study in psychology or medicine at a campus-based university in Finland. A factor analysis was carried out on their coded responses to the open-ended questions and their subscale scores. This yielded four independent factors that were characterized in the following way: externally regulated and reproduction directed learning; self-regulated, meaning directed and goal-oriented learning; constructivist epistemology (involving the construction of new knowledge structures); and active use of knowledge. The first and second factors were very similar to Vermunt and van Rijswijk's (1988) reproduction directed and meaning directed learning styles. The researchers then computed the respondents' scores on these four factors and examined the possible effects of discipline (medicine versus psychology) and academic level (first-year versus fifth-year).

The medical students obtained higher scores than the psychology students on the first factor and the fourth factor, but the psychology students obtained higher scores than the medical students on the third factor. Thus, medical students were more active yet reproduction directed, whereas psychology students were more likely to exhibit constructive ideas of learning and knowledge. This was thought to reflect the more factual demands of the curriculum in medicine as opposed to a more constructivist approach in teaching and learning psychology. The effects of academic level were largely confined to constructivist epistemology, where the fifth-year students tended to obtain higher scores than the first-year students. Adherence to dualism on the CLEV varied with both discipline and academic level: medical students were more dualist than psychology students and first-year students were more dualist than fifth-year students. When the students were classified as dualists or relativists according to their responses to the CLEV, the dualists were more likely to exhibit a reproduction directed learning style and less likely to exhibit a constructivist epistemology than the relativists; however, there was no significant difference between the dualists and the relativists in terms of their scores on meaning directed learning.

Severiens and ten Dam (1997) obtained responses to the ILS from a total of 432 students of 'adult secondary education' in the Netherlands. A factor analysis carried out on the students' subscale scores identified four factors. Three of these corresponded to the meaning-directed, reproduction-directed and undirected learning styles described by Vermunt (1998). However, the fourth factor did not reflect the application-directed learning style. Instead, it represented high scores on the mental models concerned with use of knowledge and stimulating education and on the self-test directed and vocation directed study orientations. Severiens and ten Dam argued that this
learning style was typical of secondary adult education, and they called it the 'prove yourself' directed learning style.

In Chapter 3, I referred to another study by Severiens and ten Dam (1998) in which they sought to confirm the developmental scheme devised by Baxter Magolda (1992) through interviews conducted with a further 53 students of adult secondary education in the Netherlands. Severiens and ten Dam noted that there was a broad parallel between this developmental scheme and the classification of learning styles described by Vermunt (1996), which was discussed in Chapter 4. They gave their students the subscales from the 120-item version of the ILS concerned with conceptions or mental models of learning and compared the scores obtained by students who were classified as demonstrating 'absolute knowing', 'transitional knowing' and 'independent knowing' in Baxter Magolda's scheme. Unfortunately, none of the comparisons was statistically significant. Severiens and ten Dam concluded that the apparent conceptual similarity between these two theoretical frameworks could not be confirmed empirically.

However, Baxter Magolda (1998) pointed out a different possibility: that respondents who were at different developmental levels had given similar ratings to ILS items in accordance with their different interpretations of the items themselves. As Strack and Schwarz (1992) pointed out, the responses given to standardized questionnaires are communicative and collaborative acts. In the absence of any additional guidance, respondents will endeavour to make sense of the items in questionnaires about learning and knowledge in terms of their own conceptions of learning and knowledge. One might argue that the apparent discrepancy was not between the two theoretical frameworks but rather between the use of quantitative and qualitative research methods. Indeed, the results obtained by Lonka and Lindblom-Ylänne (1996) showed that students' scores on the subscales of the ILS do correlate with their intellectual development when the latter is assessed using a quantitative instrument. Conversely, one would expect to find empirical confirmation of the relations between Baxter Magolda's scheme and Vermunt's (1996) classification of learning styles if both frameworks were assessed by means of qualitative methods. It is, in fact, puzzling why Severiens and ten Dam chose to use the ILS at all, as Vermunt's model had been based upon students' accounts in structured interviews rather than their ratings of the items in the ILS.

Busato et al. (1998) used the 120-item version of the ILS to explore whether there were any systematic changes in learning styles during the undergraduate programme in psychology at one campus-based institution in the Netherlands. They obtained responses to the ILS from 329 first-year students who had attended an obligatory test session. They also carried out a postal survey of samples of students in Years 2–5 of the same programme and obtained responses to the ILS from between 32 and 45 students in each cohort. Although there were statistically significant fluctuations in the scores obtained by students in different cohorts on the scale measuring a meaning directed learning style, there was no systematic trend on any of the scales
over the 5 years of the programme. In three of the five cohorts, the scores on the scale measuring an undirected learning style showed a significant negative correlation with the number of study points (or course credits) obtained towards their degree; however, there were no statistically significant relationships involving any of the other three scales in the ILS.

Unfortunately, there are serious problems of sampling bias in this study. The collection of data from an obligatory test session ensured a response rate of 94 per cent from the students in Year 1. In passing, it should be noted that, in other countries such as Australia and the US, requiring psychology students to serve as research participants is nowadays generally regarded as ethically questionable unless appropriate and equitable alternative activities are available for those students who do not wish to participate (Coulson 1999). In contrast, the use of a postal survey for the other four cohorts yielded at best a response rate of 22.5 per cent. In Chapter 6, I pointed out that students who respond to surveys are known to be different from those students who do not on many variables, including their approaches to studying (see Watkins and Hattie 1985). In the study by Busato et al., the effects of sampling bias might have counteracted any genuine differences between the first-year students and the other cohorts in their scores on the scales of the ILS. A separate problem is that the relatively small size of the groups sampled from the other four cohorts would have made it more difficult to obtain significant results using a cross-sectional research design (that is, a design comparing different groups of students).

Busato et al. also reported two sets of data obtained using a longitudinal design (that is, one that compared the same group of students assessed on different occasions). Of the students sampled from Year 2 of the programme, 32 had completed the ILS during an obligatory test session held 14 months previously during their first year of study. A comparison of the scores they obtained on the two occasions revealed no significant differences on any of the four scales. In a similar manner, of the students sampled from Year 3 of the programme, 26 had in fact completed the ILS on two different occasions during their first year of study in connection with another research project. In this case, there was a statistically significant trend for their scores on the scale measuring a meaning directed learning style to increase between Year 1 and Year 3. Unfortunately, there is no guarantee that this (relatively modest) trend was not peculiar to the small proportion of the cohort who chose to respond to the postal survey containing the ILS.

In Vermunt's (1998) model, Vermetten et al. (1999a) suggested that learning orientations and mental models were relatively stable but that the students' choice of processing or regulation strategies might well depend upon the content, context and assessment of a particular course. They assessed two successive cohorts of students who were each taking four different courses in the second semester of the first year of the law degree at a campus-based university in the Netherlands. Vermetten et al. compiled a questionnaire consisting of 50 items from the subscales of the ILS concerned with processing and regulation strategies, which were amended so
as to refer to a specific course. (They collapsed together the two subscales concerned with self-regulation and the two subscales concerned with external regulation.) These items were supplemented by 25 other items about problems that students might encounter while studying.

The questionnaire was then employed in a postal survey of students taking all four courses. The data analyses were confined to those students who had returned questionnaires about all of the courses and partly for this reason the overall response rates were quite low (29 and 22 per cent, respectively, for the two cohorts). However, the key question was whether there would be significant differences among the scores obtained by the same students across the four courses. There were in fact significant differences on six of the eight subscales in the first cohort and on seven of the eight subscales in the second cohort. The greatest variation across the four courses was apparent in the students' ratings of concrete processing and lack of regulation: two courses, in particular, seemed to receive more positive ratings than the other two courses as the result of the teachers' use of vivid material, practical examples and clear organization.

Nevertheless, Vermetten et al. (1999b) argued that there was genuine intellectual development as students proceeded through higher education and that this should be exhibited in changes in scores on other subscales of the ILS. They added to the 50 items in their previous questionnaire another 50 items concerned with mental learning models and study orientations. Moreover, they modified the instructions so that the respondents were asked to report specifically about the past semester. Vermetten et al. administered the resulting instrument to students in four departments of a campus-based university in the Netherlands at the end of their first and third semesters. It was distributed on both occasions in a postal survey and completed copies were returned from both surveys by 276 students.

Separate factor analyses conducted on the students' subscale scores in the two semesters tended to confirm the intended scale structure of the four major learning styles, though this was clearer after the third semester than after the first. All the correlation coefficients computed from the two scores obtained on each subscale were greater than 0.50, reflecting reasonable stability over a period of 1 year. Nevertheless, there were also statistically significant changes on eight of the scales between the two occasions:

- With regard to their processing strategies, the students showed a significant increase on the two subscales concerned with deep processing (relating and structuring, critical processing) and a significant increase on the subscale concerned with concrete processing.
- With regard to their regulation strategies, the students showed a significant increase on the subscale concerned with self-regulation.
- With regard to their mental models of learning, the students showed a significant decrease on the subscale concerned with intake of knowledge.
- With regard to their learning orientations, the students showed a significant increase on the subscales concerned with vocational orientation and
personal interest, and a significant decrease on the subscale concerned with certificate orientation.

Vermetten et al. concluded that the students as a group showed higher scores on the subscales defining a meaning-directed learning style and that, in this respect, they showed improvement in their reported quality of learning within the early years of university study. However, it should be noted that the response rates to the two postal surveys were only 42 per cent and 31 per cent, respectively, and in principle it is possible that the improved quality of learning occurred only in those students who complied with the request to participate in this study on both occasions. Vermetten et al. in fact had the data to investigate this notion, as they could have carried out a between-subjects comparison based on the students who had responded to only one of the surveys. If they had found a similar improvement in the reported quality of learning of these students, one might be more confident that this was a general phenomenon. However, they reported only the within-subjects comparison based on the students who responded to both of the surveys.

Concluding summary

- The ILS was constructed by Vermunt and van Rijswijk (1988) on the basis of students' accounts of their activities, motives and conceptions of learning in distance education and especially at the Dutch Open University. It was motivated by the idea that the influence of students' conceptions and orientations on their processing activities was mediated by their use of different regulation activities. It appears to measure four basic 'learning styles'.

- Using the 144-item version of the ILS, Vermunt and van Rijswijk found that students with previous experience of higher education were less likely to show an externally regulated and reproduction directed learning style. However, students with more experience of studying in distance education were more likely to show such a learning style. This indicates that the Dutch Open University fails to promote the adoption of appropriate approaches to studying.

- Vermunt (1998) found differences between campus-based and distance-learning students on most subscales in the 120-item version of the ILS. In general, the distance-learning students showed more desirable approaches to studying, and some differences were sufficiently large to be of practical significance. In principle, the differences could be due to confounded age differences, but Vermunt and van Rijswijk's detailed results do not support such an account.

- The pattern of relationships between students' scores on the subscales measuring different mental models of learning, orientations, regulation strategies and processing strategies tends to support the original theoretical
assumptions underlying the derivation of the ILS. However, they also imply that essentially the same mechanisms are at work both in campus-based education and in distance education.

- Students' scores on the subscales of the ILS that are concerned with processing activities and regulation activities demonstrate variability dependent upon the content, the context and the demands of particular courses. Their scores on the subscales that are concerned with learning orientations and mental models seem to be more stable, but it has been possible to show genuine improvement in the quality of learning during the early years of higher education.