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The development of a questionnaire on metacognition for students in higher education

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Background: Interest in the role of metacognition has been steadily rising in most forms of education. This study focuses on the construction of a questionnaire for measuring metacognitive knowledge, metacognitive regulation and metacognitive responsiveness among students in higher education and the subsequent process of testing to determine its validity.

Purpose: The aim of the study was to construct an original instrument for measuring features of metacognition, henceforth referred to as the Awareness of Independent Learning Inventory (AILI), and further to establish the similarities and differences between this model and existing instruments for measuring metacognition.

Sample: The AILI questionnaire was distributed to 1058 students in various types of Teacher Training Institutes in the Netherlands and Belgium. The abridged English version of the questionnaire was administered to another sample of 729 students reading Economics and Business Administration at the University of Maastricht in the south of the Netherlands.

Design and methods: The AILI instrument was constructed on the basis of a facet design along two dimensions: components of metacognition and topics of concern to students in higher education. The data gathered with the instrument was analyzed by means of a generalisability study and a decision study, respectively. The validity of the instrument was investigated by using confirmatory factor analysis.

Results: The generalisability study showed that the reliability of the instrument was satisfactory. The decision study revealed that the number of items included in the questionnaire could be reduced substantially by leaving out two components of one of the dimensions in the facet design, without losing too much generalisability. The validity study showed that there was a considerable level of congruity between parts of the AILI questionnaire and the relevant parts of the Motivated Strategies for Learning Questionnaire (MSLQ).

Conclusions: The AILI questionnaire is a reliable and valid instrument for measuring metacognitive knowledge, regulation and responsiveness. It is suitable for use in the evaluation of the effects of interventions that purport to increase metacognitive knowledge, regulation and responsiveness of students in higher education.

Keywords: metacognition; generalisability theory; reliability; validity; teacher education

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Introduction

Metacognition is an important factor in learning, including activities such as aligning oneself to a learning task, monitoring comprehension, and checking learning outcomes (Wang, Haertel, and Walberg 1993; Zimmerman 1990). Students who perform many metacognitive activities tend to attain better learning results than peers who perform few metacognitive activities. This has been shown in both field studies (e.g. Brown and Palincsar 1989; De Jong 1992) and laboratory studies (e.g. Veenman, Elshout, and Meijer 1997). Awareness of the fact that metacognition is important in students’ learning has also promoted interest in developing educational interventions that may improve their metacognitive skills, for instance, by successfully teaching pupils to regulate and control their level of comprehension during reading (Brown and Palinscar 1989). Later Van den Boom et al. (2004) investigated interventions in a web-based learning environment and improved students’ metacognition by combining reflection-prompts with tutor feedback.

In order to measure the metacognitive activities students perform and the effects of educational interventions on students’ metacognition, several questionnaires have been developed. Well-known are the Motivated Strategies for Learning Questionnaires (MSLQ; Pintrich et al. 1993) and the Metacognitive Awareness Inventory (MAI; Schraw and Dennison 1994). These questionnaires were validated in different studies and measure two broadly accepted components of metacognition: metacognitive knowledge and metacognitive regulation. The MSLQ and MAI questionnaires, however, do not measure another distinct component of metacognition, also distinguished in the literature on metacognition: metacognitive responsiveness (Flavell 1979). In this paper, the development and validation of a new questionnaire for assessing metacognition, the Awareness of Independent Learning Inventory (AILI), is described.

In contrast to the MLSQ and MAI, the AILI questionnaire addresses an added aspect of metacognition. Apart from including composites of metacognitive knowledge and metacognitive regulation, it also comprises the component metacognitive responsiveness. Moreover, this article addresses the issue of the intertwining of metacognition and cognition, as well as looking into metacognition as a trait versus metacognition as a state.

We will provide a brief review of the literature on metacognition, followed by a description of the way in which the AILI questionnaire was constructed. Subsequently, we will describe the results produced by different studies in order to assess the validity of the AILI questionnaire. In the discussion, we will reflect on its potential uses, its limitations and suggested directions for future fine-tuning.

Theoretical framework

In this section, the topics that were addressed in the introduction are described in more detail.

The two components: metacognitive knowledge and metacognitive regulation

Metacognition as a theoretical construct originates from the work of Flavell (1979, 1987) and Brown (1987) who describe it as a composite of knowledge of cognition and regulation of cognition. Knowledge of cognition refers to ‘the knowledge or beliefs about what factors or variables interact in what ways to affect the course and outcome of cognitive enterprises’ (Flavell 1979, 907). Flavell made a distinction between metacognitive knowledge with respect to the person, the task or the strategy. Similar
subdivisions were made by others. Paris, Cross, and Lipson (1984), for instance, suggested a subdivision in declarative metacognitive knowledge (knowledge about one’s general processing abilities), procedural metacognitive knowledge (knowledge about how to successfully solve problems), and conditional metacognitive knowledge (knowledge about when to employ specific strategies). Regulation of cognition refers to how well people regulate their cognitive activities in actual practice. Again, several subcomponents have been suggested. Schraw (1998), for instance, conceptualised metacognitive regulation as an interaction between three types of processes, namely regulatory control, performance monitoring and task monitoring. Van Hout-Wolters (2000) suggested a subdivision in preparatory metacognitive activities (such as an alignment towards a specific learning strategy), executive metacognitive activities (such as monitoring learning outcomes), and closing metacognitive activities (such as reflecting).

Responsiveness to metacognitive experiences

A component of metacognition that has received relatively little attention relates to metacognitive experiences. Flavell (1979) defined metacognitive experiences as ‘any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise’ (Favell 1979, 906). Examples given were: ‘You believe/feel that you have almost memorised those instructions; you are not adequately communicating how you feel to your friend; you are suddenly stymied in your attempt to understand something you are reading; you have just begun to solve what you sense will be an easy problem (…)’ (Favell 1979, 908). Flavell suggested that metacognitive experiences are both related to metacognitive knowledge and metacognitive regulation, but cannot be subsumed under either of these. A metacognitive experience may affect a person’s metacognitive knowledge-base by adding to it, deleting from it or revising it. Metacognitive experiences can also affect metacognitive regulation. Thought and feelings about one’s cognitive functioning may lead, for instance, to changing one’s strategy, or to establishing new goals.

The consequences of a person’s awareness of personal cognitive functioning are also discussed in the work of other researchers. Schön (1983) described the process of ‘reflection-in-action’, a reflection process which starts with a sensitivity to one’s own beliefs and feelings that may have an influence on the execution of a task. Marzano, Pickering, and McTighe (1993) drew attention to the importance of ‘being sensitive to feedback on one’s functioning and strategy-use’. Such feedback may come from external sources, but it can also be supplied internally, by metacognitive experiences that occur during the execution of a task.

Butler and Winne (1995) and Schraw (1998) advocated that teachers should promote ‘general awareness of the importance of metacognition’, for instance by modelling metacognition, i.e. showing and discussing how they think about and monitor their performance. If metacognition is an important determinant of learning results, as Wang, Haertel and Walberg (1993) concluded on the basis of a meta-analysis study, then metacognitive instruction may enhance educational performance. Modelling metacognitive activity by teachers can induce similar activity in students. For instance, one might explain how initial orientation will help you to make a more suitable plan; how monitoring interim results in a problem-solving process can help students in keeping track; and how evaluation can help to check inaccuracies. All these activities will contribute to students solving problems more adequately and more efficiently.
To reiterate, there are several aspects of metacognition that are, in general, not subsumed under the components ‘metacognitive knowledge’ and ‘metacognitive regulation’. In the following, the term ‘metacognitive responsiveness’ is used to refer to these aspects, which include students’ sensitivity to metacognitive experiences (Flavell 1979); general awareness of metacognition and the importance thereof; and curiosity to learn about metacognition by information and feedback.

**Metacognitive and cognitive strategies intertwined**

Flavell (1979) distinguished metacognitive strategies from cognitive strategies. Metacognitive strategies are applied for the purpose of monitoring, checking or regulating cognitive processes, and cognitive strategies are applied for the purpose of making cognitive progress. Flavell also pointed out, however, that the same strategy, such as ‘summarising main points of a text’ might be invoked for either metacognitive or cognitive purposes, and that the effects of activities that students engage upon are intertwined, regardless of what the purpose might be. Intertwinement refers to the fact that the employment of a strategy does not inform us as to the purpose of its employment, and the purpose of its employment does not play a decisive role in attaining a result.

Intertwinement leads to interpretation problems and thus threatens the validity of the classification of activities as cognitive or metacognitive. For example, executing a cognitive strategy such as ‘first reading only the headlines of a given text’, is a purely cognitive activity in itself, but the purpose of it may be of a metacognitive nature, such as familiarising oneself with the text before reading it entirely (Meijer, Veenman, and Van Hout-Wolters 2006). Although intertwinement between cognitive and metacognitive strategies does occur when students learn, researchers should make a determined attempt to explicate cognitive and metacognitive strategies both empirically and conceptually if they are to measure the concept of metacognition in a valid way.

**Metacognition as a trait or a state**

O’Neil and Abedi (1996) introduced the idea of metacognition as a trait and contrasted it with metacognition as a state, analogous to Spielberger’s (1975) distinction between trait or state personality characteristics, for instance when categorising features like anxiety. O’Neil and Abedi focused on metacognitive regulation, which they subdivided into planning, monitoring or self-checking both cognitive and affective strategies and self-awareness. State metacognition, they suggested, refers to a transitory state people find themselves in when performing these activities in intellectual situations. The state varies in intensity, changes over time, and is easily affected by incentives. Trait metacognition, in contrast, refers to a relatively stable predisposition, i.e. responding to intellectual situations with a certain degree of state metacognition.

Research on metacognitive skilfulness (Veenman, Elshout, and Meijer 1997; Meijer, Veenman, and van Hout-Wolters 2006) provides empirical support for the conceptualisation of metacognition as a trait. In these studies, participants passed through a number of different learning tasks in various domains, and their metacognitive skilfulness was assessed. Metacognitive skilfulness was operationalised in terms of the quality and quantity of the working methods used. The results showed a considerable degree of generality of metacognitive skills across tasks and domains. However, the Meijer et al. study (2006) showed, in addition, that the relation of metacognition and study results was inconsistent across study domains, thereby supporting the notion of metacognition as a state, i.e. at least context-dependent.
Existing questionnaires on learning-related metacognition

Several questionnaires address metacognition. Well-known are the MSLQ (Pintrich et al. 1993) and the MAI (Schraw and Dennison 1994).

According to its authors, the MSLQ is: ‘an instrument designed to assess college students’ motivational orientations and their use of different learning strategies for a college course’ (Pintrich et al. 1993, 801). Its 81 items are divided into the sections Motivation, Affective Strategies, Cognitive and Metacognitive Strategies, Resource Management Strategies and Resource Strategies. Each of these sections, with the exclusion of Affective Strategies, is subdivided in separate scales that can be used together or separately. Cronbach’s α’s for the sub-scales range from 0.52 to 0.93 (Cronbach et al. 1972). The MSLQ addresses motivation and learning strategies at course level, e.g. ‘I like the subject matter of this course’; ‘When I become confused about something I’m reading for this class, I go back and try to figure it out’. The MSLQ has been used in numerous studies in secondary and higher education, not only to assess students, but also to evaluate courses and educational interventions (Duncan and McKeachie 2005). Academic staff can use the MSLQ to obtain feedback on their students and help to guide decisions about course adjustments. Also, students can use the questionnaire for self-diagnosis of their strength and weaknesses in any of their courses.

The MAI is presented by the authors as ‘an easily administered metacognitive inventory suitable for adolescents and adults’ (Schraw and Dennison 1994, 461). Its purpose is to identify highly metacognitive learners. It consists of 52 items that concern Metacognitive Knowledge and Regulation of Cognition. The MAI questionnaire is primarily used for research purposes.

The MSLQ and MAI questionnaires mainly focus on two of the most important components of metacognition: metacognitive knowledge and metacognitive regulation. However, metacognitive responsiveness, although also considered another important distinct component of metacognition, is not measured by either the MSLQ or MAI. Nevertheless, questions about metacognitive responsiveness could add to the overall picture of students’ metacognition and increase the potential usability of the questionnaire – for instance, in situations where it is seen as an educational goal to raise students’ general awareness of metacognition.

Although both questionnaires focus on a distinction between metacognitive knowledge and metacognitive regulation, we are of the opinion that they do not avoid the problem of the intertwining of cognition and metacognition. Therefore we suggest that the validity of the questionnaires can be questioned. Also, in our opinion it remains unclear which approach to metacognition, as a trait or as a state, lies at the root of the MSLQ and MAI. It is argued that the distinction between state metacognition and trait metacognition is relevant for the construction of a questionnaire on metacognition.

After having considered the literature on the development of metacognition, and in view of these perceived limitations, it was decided to construct a questionnaire for assessing metacognition that was particularly designed for students in higher education. Although it appears to be possible to assess the metacognitive ability of younger students in terms of thinking-aloud protocols, it seems problematic to do so when administering questionnaires to this age-group (Veenman 2005; Meijer, Veenman, and Van Hout-Wolters 2006). Moreover, the questionnaire was developed in the context of a research project concerning the metacognitive ability of students in higher vocational education, i.e. trainee teachers.
The aim of the present paper on the AILI

The AILI was developed in 2001 and some details about its development can be found in Elshout-Mohr, Daalen-Kapteijns, and Meijer (2001a, 2001b, 2004a, 2004b, 2004c) and Strijbos, Meeus, and Libotton (2007). Therefore, the purpose of this paper is to illustrate the development of the AILI and shed light on the way the questionnaire can be used in higher education. Up until now, report of its use has been published (Meeus, Van Petegem, and Meijer 2008a, 2008b), but detailed information on its development and the model that guided the construction of the questionnaire is missing from the literature.

Construction of the AILI

Focus

The AILI questionnaire was constructed for use in higher education and gauges students’ metacognition skills over a broad range of topics that are relevant for regulating their studying and learning. It is intended to be an instrument for gaining insight into the effects of educational interventions on students’ metacognition abilities. Two parallel versions of the AILI were constructed – AILI A and AILI B. These were designed so they could be used before and after an intervention in order to assess the effect of the intervention on students’ metacognitive abilities.

There are three aspects in the construction of the questionnaire that were intended to distinguish the AILI from other questionnaires intended to assess metacognition:

1. The conceptualisation of metacognition as a composite of three components, namely metacognitive knowledge, metacognitive regulation and metacognitive responsiveness.

2. Strict avoidance of statements in which cognitive and metacognitive questions are intertwined. No questions should be included about specific strategies, because such questions can lead to the misinterpretation of students’ reports and when bringing their metacognitive activities to the fore may deny the students equal opportunities to demonstrate their metacognitive abilities.

3. The conceptualisation of metacognition as a trait. We decided to approach metacognition as a trait in order to make the questionnaire suitable for measuring changes in metacognition that are the intended outcome of powerful metacognition-oriented educational interventions. Although metacognition is conceptualised as a trait rather than as a state, it is believed that changes in metacognition can occur as a result of powerful interventions. In other words, the questionnaire is intended as an assessment tool for determining substantial changes in metacognition.

Apart from metacognitive components, the learning experiences of students in higher education are also guided by topics of concern, i.e. things they find important during their education. ‘Topics of concern to students in Higher Education’ thus formed the second facet in this study, with the first facet being ‘Metacognition’. The topics of concern were represented by seven topics selected by consulting books, readers and research reports on ‘effective studying’ in Higher Education (e.g. Richardson, Eysenck, and Piper 1987), and websites referring to meta-studies on ‘effective learning and studying’ (e.g. http://www.apa.org/ed/lcp2/lcp14.html). To be more concise, these topics were labelled (1) learning goals, (2) emotional interest, (3) collaborative learning, (4)
deep understanding, (5) orderliness and systematic approach, (6) appreciation by relevant others, and (7) using facilities.

**A facet design**

As indicated above, to construct the questionnaire on learning-related metacognition (AILI), we used a facet-design (Shavelson and Webb 1992; Brennan 2001). The AILI questionnaire was thus based on these two facets (i.e. ‘metacognition’ and ‘topics of concern to students in Higher Education’; Elshout-Mohr et al. 2003), which acted as a guideline for the wording and compilation of 63 questions further divided into nine sections of seven questions.

Within the facet of metacognition, the three components of metacognition were each further subdivided. Specifically, metacognitive knowledge was subdivided into (a) knowledge about people, (b) knowledge about strategies, and (c) knowledge about study tasks. Metacognitive regulation was subdivided into (a) orientation on personal functioning in a learning-episode, (b) monitoring execution of a learning-episode, and (c) evaluation of personal functioning in a learning-episode. Metacognitive responsiveness was subdivided into (a) sensitivity to metacognitive experiences (internal feedback during a learning episode), (b) sensitivity to external feedback on personal cognitive functioning, and (c) curiosity with regard to personal cognitive functioning and development. Thus, the facet of metacognition was covered by nine subcomponents. As explained above, the facet topics of concern consisted of seven elements.

By using generalisability theory (Brennan 2001) for the analysis of the results, it is possible to use facet design to its best advantage. In the analysis of generalisability, variance components can be intertwined with their sources, i.e. persons, both facets, and their interactions.

**Item construction**

Four steps were taken in the item-construction process. First, a standard item-format was designed. Each item consists of a statement followed by a seven-point Likert scale rating system, on which respondents are required to indicate to what extent the statement applies to them. An example of a statement is: ‘While working on an assignment, I attend to all parts of it’. Point 1 of the scale indicates ‘not true at all’, point 4 indicates ‘neutral, don’t know’, and point 7 indicates ‘completely true’.

Second, equivalent terms and expressions were sought for concepts related to metacognitive components and topics that were to be used in several items. Equivalent terms were used alternately in order to avoid the repetition of a small number of terms, which would have been boring for respondents, and to eschew uncontrolled variation of terms, which would deviate from the facet design. As equivalent terms for ‘to monitor’, for instance, we used ‘to keep an eye on’ and ‘to pay attention to’; as equivalents for ‘academic task’, we used ‘studying task’, and ‘assignment’. We selected as equivalents for ‘orderly’, the words ‘systematic’ and ‘methodical’, and so on.

Third, 63 statements were composed, one statement for each combination of a metacognitive sub-component (of which there were nine) and a topic of concern (of which there were seven). Thirty-two statements were formulated positively (e.g. ‘While I’m carrying out an assignment, I try to keep an eye on what others will think of my work’) and 31 items were formulated negatively (e.g. ‘While working on an assignment, I don’t pay much attention to whether I am carrying out all parts of it’). In a parallel
version of the AILI questionnaire (the AILI B questionnaire), all positively formulated items were formulated negatively and vice versa. In presenting approximately half of the items negatively and the rest positively, the idea was to exclude the undesirable effects caused by ‘yea-sayers and nay-sayers’ (Nardi 2003).

Fourth, the intertwinement of cognition and metacognition was aimed to be avoided by excluding cognitive strategies from the items as much as possible. For instance, the first two items of the AILI (A) questionnaire read: ‘I know which assignments students really need to work at systematically’ and: ‘I think it’s necessary to make a conscious effort to work systematically when you are studying’, respectively. Although the need to work systematically is a cognitive goal, knowing which assignments students need to work at, and the necessity to make a conscious effort in order to achieve this goal are of a metacognitive strategic nature.

Finally, in a pilot study, the AILI was presented to 30 trainee teachers, aged 19–20, in their first year of higher vocational education. Ten of these were invited to fill out the AILI questionnaire at an individual session while thinking aloud to find out how they actually reacted to it and whether they were encountering any problems. No problems were encountered with the wording of the questions. More information about the construction of the parallel versions of the AILI can be found in Elshout-Mohr, Daalen-Kapteijns, and Meijer (2001a, 2001b, 2004a, 2004b, 2004c) and Strijbos, Meeus, and Libotton (2007). Version A of the final, shortened AILI, consisting of 45 items each (see further), is included in the Appendix. Also, an overview of the structure of the AILI is given in Figure 1.

**Method**

**Samples**

The AILI questionnaire was administered to a total of 1058 students across various types of teacher training institutes for primary and secondary education in The Netherlands (n=642) and Belgium (n=416). The sample included first-year students, sophomores (second-year college students) and senior students. Of the Dutch students,
62 took their grade in Dutch, 84 in English, 41 in French, 126 in History, all for teacher training in secondary education, and 329 were in teacher training for primary education (for detailed information, see Elshout-Mohr, Daalen-Kapteijns, and Meijer 2004c). Of the entire sample, 324 students had begun their studies before 2000. A second sample of 729 mostly foreign students was involved in the administration of the shortened version of the AILI questionnaire, which was available in English as well (see further). These students were from the Education and Business Administration Department of the University of Maastricht.

**Procedure**

Administration of the AILI questionnaire took 25 minutes. Students filled out the questionnaire on paper in class. Teachers were present during administration and adhered to the following guidelines. An important aspect of the procedure is that respondents were given no reason to offer socially desirable answers, i.e. rewards like giving study credits to students who gain high scores for metacognition on the questionnaire were avoided. Students were instructed to read the introduction to the questionnaire very carefully, before they started to fill it out.

**Analyses**

As mentioned earlier, we used a facet-design to construct our questionnaire. Since the items in the questionnaire were constructed by crossing two facets (i.e. nine subcomponents of metacognition and seven topics of concern), it may be expected that the total variance of the items will be partly bound to respondents, partly to each facet (facet 1: metacognition and facet 2: topics of concern) and partly to the interactions between these two. By applying generalisability theory, this expectation can be tested. A Generalisability study and a Decision study were performed.

The generalisability coefficient $G$ provides an estimate of the extent to which it is justified to generalise the AILI data to take on a broader universe of metacognitive components (facet 1) and topics of concern (facet 2). In other words, the $G$ coefficient renders an indication of the reliability of the instrument, which is broader than a measure of its internal consistency.

The aim of the Decision study was to investigate whether the selected numbers of nine components (for the facet ‘metacognition’) and seven topics (for the facet ‘topics of concern’) were necessary from the point of view of generalisability. A Decision study seeks to establish the consequences of a reduction of the number of categories within each facet.

Although the inclusion of fewer components and topics will always lead to less generalisability, i.e. lower values of the $G$ coefficient, the loss may be acceptable if it is not very substantial.

In addition to the Generalisability study and the Decision study, we also tested the convergent and discriminant validity of the newly constructed questionnaire by comparing the AILI questionnaire with another questionnaire that is constructed to measure metacognition. For this purpose, the MSLQ questionnaire was chosen, which is a widely applied and well established instrument (Pintrich et al. 1993).

In order to test whether metacognition as measured by the AILI questionnaire is a trait rather than a state, test–retest correlations were calculated using data from a small subsample of 34 students who were tested in their first year of study (in 2001) and retested in their third year (in 2003).
Results

Generalisability study: procedure and results

In the Generalisability study, students are the objects of measurement. Any response, i.e. any score ranging between one to seven in an item allocated to a particular student, can be written as the sum of the grand mean in the universe, three main effects for respectively persons, components of metacognition and topics of concern, three two-way interaction effects and a three-way interaction. The variance $\sigma^2$ of these scores can be written as:

$$\sigma^2(X_{pc}) = \sigma^2(p) + \sigma^2(c) + \sigma^2(t) + \sigma^2(pt) + \sigma^2(ct) + \sigma^2(pct)$$

wherein $p$ denotes persons, $c$ denotes components and $t$ denotes topics. It is assumed that the population of students in the target group and the universes of both facets (components and topics) are quite large (approaching infinity, theoretically) and that random samples were drawn from this population and the universes of components and topics. Variance components other than $\sigma^2(p)$ contribute to error variance. Brennan (2001) distinguishes absolute error variance $\sigma^2(\Delta)$ and relative error variance $\sigma^2(\delta)$. Absolute error is the difference between a person’s observed score and a person’s universe score.

Its variance equals:

$$\sigma^2(C) + \sigma^2(T) + \sigma^2(pC) + \sigma^2(pT) + \sigma^2(CT) + \sigma^2(ct) + \sigma^2(pCT)$$

i.e. the sum of all other variance components other than $\sigma^2(p)$. The uppercase subscripts denote that the terms refer to variance of mean scores for persons, rather than single person–component-topic observations. These terms are obtained by dividing variance components by a denominator equal to the number of levels of each facet and their product in the case of their interaction and the three-way interaction.

Relative error is defined as the difference between a person’s observed deviation score and that person’s universe deviation score. Its variance is the sum of all interaction components, which contain a person subscript. It equals: $\sigma^2(pC) + \sigma^2(pT) + \sigma^2(pCT)$. The relative error term is used for the calculation of the generalisability coefficient $G$. $G$ is the ratio of universe score variance to itself plus relative error variance. The generalisability coefficient is the analogue of a reliability coefficient in classical test theory. It is a rational number between 0 and 1, larger values indicating higher generalisability.

The variance components of the AILI questionnaire scores were estimated with the use of the computer programme GENOVA (Generalised Purpose Analysis of Variance System; Crick and Brennan 1983). The first two columns of Table 1 give an overview of the results of the Generalisability study.

The first column gives the notation for the variance components; $\sigma^2(\Delta)$ is the absolute error variance, $\sigma^2(\delta)$ is the relative error variances, $\sigma^2(p)$ is the estimated variance of the expected scores of respondents over all nine components and seven topics, and $\sigma^2(pc)$ is the estimated variance of the expected scores attributable to the interaction between and the components of metacognition. The last row of Table 1 presents the generalisability coefficient $G$. Its value of 0.82 is satisfactory. The second column presents the estimated variance attributable to each component.

The estimated variance attributable to respondents $\sigma^2(p)$ is 0.251. This indicates that respondents vary substantially in their responses. The estimated variance attributable to
components of metacognition $\sigma^2(c)$ indicates the extent to which persons vary in their responses to the various components.

The estimated variance attributable to topics $\sigma^2(t)$ is nil, implying that respondents do not vary in their responses to various topics in a statistically significant way.

Variance components $\sigma^2(pc)$ and $\sigma^2(pt)$ estimate the extent to which respondents are rank-ordered differently by components and topics, respectively. The data indicate that the rank orders of respondents across components differ more from each other in comparison to the rank orders across topics. $\sigma^2(pc)$ is almost twice as large as $\sigma^2(pt)$. This is a second indication that components are a more important source of variation than topics.

Based on these results, it can be concluded that the generalisability of the AILI questionnaire is satisfactory. It is, thus, justified to generalise results to a broader domain of metacognitive components and topics than just the nine components and seven topics incorporated in the questionnaire.

**Decision study: procedure and results**

A Decision study aims at estimating the size of the error variances (and thus $G$) as a function of the number of conditions of measurement in the measuring procedure. A Decision study differs from a Generalisability study in that it focuses on the variance of average scores over facets rather than the variance of person-facet combinations. The expected value of the means of these average scores is the person’s so-called universe score. Universe score variance is the variance of universe scores over all persons in the population. It is similar to the concept of true score variance in classical test theory. Estimates of Decision study variance components are obtained by dividing the Generalisability study estimates by the sample sizes of the facets in the measurement procedure. These denominators are listed in the third column in Table 1. By substituting different values for the number of metacognition-components and topics in the calculation of Decision study variance components, it is possible to estimate the size of the error variances and thus $G$ as a function of their number. For example, diminishing the number of components to eight rather than nine would render another value of $\sigma^2(c)$ and thus also another value of $G$.

The computer programme GENOVA (Crick and Brennan 1983) was used for these calculations. Figure 2 gives a graphical presentation of the results, which were obtained by substitution of the values 1 to 9 for the number of metacognition-components and the values 1 to 7 for the number of topics.

### Table 1. Variance components in the Generalisability study for the Awareness of Independent Learning Inventory.

<table>
<thead>
<tr>
<th>Variance component</th>
<th>Estimate</th>
<th>Denominator</th>
<th>Decision study variance component</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma^2(p)$</td>
<td>0.251</td>
<td>1</td>
<td>0.251</td>
</tr>
<tr>
<td>$\sigma^2(c)$</td>
<td>0.146</td>
<td>9</td>
<td>0.016</td>
</tr>
<tr>
<td>$\sigma^2(t)$</td>
<td>0.000</td>
<td>7</td>
<td>0.000</td>
</tr>
<tr>
<td>$\sigma^2(pc)$</td>
<td>0.153</td>
<td>9</td>
<td>0.017</td>
</tr>
<tr>
<td>$\sigma^2(pt)$</td>
<td>0.077</td>
<td>7</td>
<td>0.011</td>
</tr>
<tr>
<td>$\sigma^2(ct)$</td>
<td>0.330</td>
<td>63</td>
<td>0.005</td>
</tr>
<tr>
<td>$\sigma^2(pct)$</td>
<td>1.622</td>
<td>63</td>
<td>0.026</td>
</tr>
<tr>
<td>$\sigma^2(\Delta)$</td>
<td></td>
<td></td>
<td>0.075</td>
</tr>
<tr>
<td>$\sigma^2(\delta)$</td>
<td></td>
<td></td>
<td>0.054</td>
</tr>
<tr>
<td>$G$</td>
<td></td>
<td></td>
<td>0.824</td>
</tr>
</tbody>
</table>

Note: $\sigma^2(\Delta)$ is absolute error variance, $\sigma^2(\delta)$ is relative error variance, $G$ is generalisability coefficient.
On the ordinate axis, the number of components is plotted. The seven lines in the graph represent the number of topics. The values of the estimated $G$ coefficients are connected by these lines. Naturally, the larger the number of components and topics included, the higher the value of $G$. In order to take decisions about the number of metacognition-components and topics, one should look at the distances between the lines and the slopes of the lines. Looking at the distances between the lines, one might conclude that relatively little information is gained by exceeding the number of five topics. The slopes of the lines suggest that relatively little is gained by exceeding the number of five components.

The decision study indicated that deleting two topics of concern or two subcomponents of metacognition would not lead to a serious loss in generalisability. Since the (sub)components of metacognition are more strongly well founded in theory than the topics of concern, and also the contribution of topics to the variance of universe scores was not significant, it was decided to drop two topics of concern rather than deleting a metacognitive component.

In order to confirm the results of the Decision study, we created an abbreviated version of the AILI questionnaire by deleting the 18 items that were related to the concerns of ‘obtaining appreciation by relevant others’ and ‘making use of facilities’ (topics 6 and 7). The first five topics were retained because they are theoretically more strongly related to independent learning than the last two topics. Coefficient $G$ decreases to a value of 0.79, which hardly differs from the value with seven topics present (0.82). So, the decision to delete the 18 items related to topics of concern 6 and 7 was taken on an empirical basis as well as a theoretical basis. Coefficient $G$ does not decline dramatically and the topics of concern specified are less well grounded in theory. To our knowledge, there is no rigorous statistical criterion for testing a significant decline of coefficient $G$.

The resulting test thus contains 45 items and was administered to a sample of 729 students attending courses in Economics and Business Administration at the University of Maastricht in the Netherlands. Because the course was given in English rather than Dutch, the AILI questionnaire was first translated in English. The translator did not just translate the items, but also followed the original steps of collecting equivalent terms and reproducing the aforementioned negative linguistic formulations.
Table 2 presents Cronbach’s α, mean scores and standard deviations for the three components of metacognition. Corresponding data from the study with Dutch and Flemish trainee teachers are presented between brackets. The similarities of means and standard deviations are noticeable. As predicted by the Decision study, the homogeneity of the components is scarcely altered by deleting two topics.

Table 2. Cronbach’s α, mean scores and standard deviations of Awareness of Independent Learning Inventory scales (abbreviated, English version).

<table>
<thead>
<tr>
<th></th>
<th>Metacognitive knowledge</th>
<th>Metacognitive regulation</th>
<th>Metacognitive responsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronbach’s α</td>
<td>0.79 [0.80]</td>
<td>0.84 [0.81]</td>
<td>0.77 [0.78]</td>
</tr>
<tr>
<td>Mean score</td>
<td>4.90 [5.03]</td>
<td>4.94 [4.91]</td>
<td>5.17 [5.15]</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.59 [0.61]</td>
<td>0.71 [0.72]</td>
<td>0.61 [0.62]</td>
</tr>
</tbody>
</table>

Note: Scores for negatively formulated items were reversed; corresponding results from the study with Dutch and Flemish participants are presented between brackets.

Correlations between the components were somewhat higher than in the first study. Knowledge correlated 0.64 with regulation as well as responsiveness; the latter two showed a correlation of 0.69. In the first study, these correlations were 0.56, 0.59 and 0.67, respectively. The resemblance between the outcomes of both studies indicates that the AILI questionnaire confirms that learning-related metacognition that students develop is similar in different sections of Higher Education, and that the English version of the AILI questionnaire obtains very similar results to the Dutch version.

Validity: correspondences between AILI and MSLQ questionnaires

In order to establish the convergent and discriminant validity of the AILI questionnaire, correspondences between the AILI (abbreviated English version) and the MSLQ (Pintrich et al. 1993) were investigated. Both questionnaires were filled out by 729 students in economics and business administration. The MSLQ questionnaire covers motivational and strategic aspects of learning and has a hierarchical structure. The motivational aspects are value and expectancy as well as an affective component that pertains to test anxiety. All three aspects are measured by a varying number of subscales. The strategic aspects concern cognitive and metacognitive strategies and management aspects of learning. Cognitive and metacognitive strategies are measured by five subscales, while the management aspects of learning are subdivided into resource management and resource management strategies. For detailed information on the structure of the MSLQ, see Duncan and McKeachie (2005), which describes the history of the development of the MSLQ and its structure.

The diversity of the aspects makes the MSLQ questionnaire suitable for convergent and discriminant validation of the AILI questionnaire. High correlations are to be expected between metacognition (all three components) as measured by the AILI and the metacognitive self-regulation scale of the MSLQ. The questions about ‘Metacognitive Self-Regulation’ are very similar to AILI items and seem to stem from similar notions about the ‘topics of concern’ that students have to deal with at a cognitive and metacognitive level. Moderate correlations are expected between all three components of the AILI and the measures for Motivational and Management aspects of learning as measured by the MSLQ, i.e. the factors Value, Expectancy, Resource Management Strategies and Resource Management. While some of the MSLQ-questions in these
categories address issues such as goal-orientation, that are also addressed in the AILI, other questions address issues such as perceived self-efficacy, that are not directly related to metacognition as conceptualised in the AILI. Finally, a non-significant correlation is expected between metacognition as measured by the AILI and test anxiety. There is no reason to assume a relation between metacognition and test anxiety.

A confirmatory factor analysis (CFA) was carried out. The observed scores on the subscales of the AILI and the MSLQ were regressed on the factors they were supposed to measure. For instance, intrinsic goal orientation, extrinsic goal orientation and task value were assumed to load only on the factor ‘value’ for the MSLQ. Analogously, orientation, monitoring and evaluation were only allowed to load on the factor metacognitive regulation of the AILI. The correlations between the three factors that represent the three main components of the AILI and the six factors of the MSLQ were computed. The results are presented in Table 3.

The correlations between factor scores in Table 3 were supplemented with correlations between observed scores on subscales. It must be emphasised that the correlations between observed scores on subscales cannot be compared directly with correlations between factor scores. The latter are always higher due to the correction for attenuation, which is inherent to CFA. For clarity, correlations between factor scores will be denoted by , and correlations between observed scores by .

Table 3 shows high correlations (0.67<<0.73) between the three AILI factors and the MSLQ factors Cognitive and Metacognitive Strategies. Analysis at the level of observed scores on subscales, showed that the highest correlation (r=0.60) was found between metacognitive regulation as measured by the AILI scale and the MSLQ scale on Metacognitive Self-Regulation. The next highest correlation was that between AILI metacognitive regulation and MSLQ Elaboration, which was 0.54. These correlations differ significantly (z=2.35, p<0.01) thus showing that the correlation between the observed scores on AILI metacognitive regulation and MSLQ Metacognitive Self-Regulation is indeed the highest. This finding was interpreted as an indication of convergent validity.

Somewhat lower correlations (0.58<r<0.69) were found between the three scales of AILI and the motivational scales Value and Expectation and the management scales Resource Management Strategies and Resource management as measured by the MSLQ. The lowest correlations (0.20<r<0.25) were found between the AILI scales and

Table 3. Correlations between three Awareness of Independent Learning Inventory (AILI) factors and six Motivated Strategies for Learning Questionnaire (MSLQ) factors (Duncan and McKeachie 2005).

<table>
<thead>
<tr>
<th>AILI factors</th>
<th>MSLQ factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metacognitive knowledge</td>
<td>0.58*</td>
</tr>
<tr>
<td>Metacognitive regulation</td>
<td>0.58*</td>
</tr>
<tr>
<td>Metacognitive responsiveness</td>
<td>0.61*</td>
</tr>
</tbody>
</table>

Note: *p<0.001.
the subscale Extrinsic Goal Orientation of the MSLQ, i.e. the degree to which the student perceives him/herself to be participating in a task for reasons such as grades, rewards, performance, evaluation by others and competition. Relatively low too were the correlations (0.34<r<0.46) of the three AILI scales regarding Expectancy, the second motivational factor of the MSLQ. The factor Expectancy consists of the subscales Control of Learning Beliefs, i.e. the students’ beliefs that their efforts to learn will result in positive outcomes, and Self-Efficacy for Learning and Performance, i.e. the students’ beliefs that they will perform well, are able to accomplish a task and have confidence in their skills to perform the task. Finally, Table 3 shows non-significant correlations (−0.06<<0.08) between the three AILI factors and test anxiety, as measured by MSLQ. This finding is an unambiguous indication of discriminant validity, because the AILI was not designed to measure test anxiety.

All in all, the pattern suggests that the AILI components correspond to MSLQ scales and subscales that deal with learning (in relation to intrinsic learning goals and management aspects of learning) rather than performance (in relation to extrinsic learning goals, grades, success and failure). In other words, the findings indicate that the questionnaire does indeed measure learning-related metacognition, as we intended it to do.

Metacognition as trait

A sample of 34 students who were tested in their first year of study (in 2001) was retested in their third year (in 2003). Test–retest correlations were 0.46, 0.39 and 0.25 for metacognitive knowledge, regulation and responsiveness, respectively. The former two correlations are statistically significant (p<0.05); the latter is not. Although the correlations are not very high, it should be borne in mind that the time that elapsed between the test and retest was rather extended, i.e. approximately two years. The findings thus suggest that metacognitive knowledge and regulation, as measured by the AILI questionnaire are possibly relatively stable traits. Metacognitive responsiveness as measured by the AILI questionnaire may be more dependent on the educational context. However, the size of the correlations and the small sample that could be used to calculate these cast doubt on this interpretation of the findings.

Discussion

The construction of the AILI was described. The AILI is an instrument to obtain a rather complete picture of self-reported learning-related metacognition. It assesses students’ self-perceived metacognitive knowledge, regulation and responsiveness in regard to a broad range of topics that are of concern for students in higher education. A so-called Generalisability study indicated that the findings could be generalised to a broader range of metacognitive components and topics of concern than were actually included in the questionnaire.

The total score on the full version of the AILI that contains 63 questions is the most reliable score. For most practical purposes, the abbreviated version (45 items) would be suitable. A decision study indicated that removal of two of the original seven topics would decrease the generalisability-coefficient of the questionnaire only slightly, and an empirical study showed that abbreviation of the questionnaire affected Cronbach’s α only marginally.

In a small subsample (n=34) the AILI scores for metacognitive knowledge and metacognitive regulation were relatively stable over time. After a two-year period, the
test–retest correlations were 0.46 and 0.39, which may indicate that the AILI measures these two aspects of self-reported metacognition as a trait more than the third aspect. The test–retest correlation for metacognitive responsiveness was 0.25, a finding that suggests that students’ self-reported metacognitive responsiveness might be more dependent on context or study phase than the other two aspects of metacognition. The correlations are certainly not very high. This suggests, on the contrary, that all three aspects are modifiable and may thus be fostered by instruction. The trait–state distinction is a complex question and full consideration is beyond the scope of this paper. A trait, in the sense of a personality characteristic such as extraversion, is supposed to be stable, but it is impossible to make predictions about particular individual behaviour in the future. Instead, personality psychologists focus on predictions at higher levels of aggregation (Hofstee 1994). We realise that the idea that the AILI questionnaire can be used to evaluate the effects of educational interventions contradicts the conception of metacognition as a trait. Therefore, we conclude that on the basis of our results, the question of whether metacognition is a trait or a state cannot be readily resolved.

Whether we have succeeded in avoiding intertwinement between cognition and metacognition in the AILI questionnaire is not certain. Although we tried to formulate the content of the items without reference to cognitive strategies, we were unable to check the lack of intertwinement empirically. The best way to do this would be to investigate the correlation of AILI scores with pure metacognitive strategy measures and a pure measure of cognitive strategy use. Because the items in the scale for cognitive and metacognitive strategies in the MSLQ are per definition intertwined, this distinction could not be made in the analysis of convergent and divergent validity.

Component and subcomponent scores of the AILI are highly correlated, but the availability of separate scores may be useful in educational or research settings. For instance, teachers might use (sub)component scores as input for a discussion on students’ ideas about metacognition and as a means to call attention to aspects of metacognition that students seem to neglect. When the AILI questionnaire is used in a pre- and post-test design to investigate effects of educational metacognition-oriented interventions, the scores for components and subcomponents may be used as an instrument to look into the effects in detail. Which components were affected the most? Were the effects of the training bound to specific topics of concern for the students or were they more general? In a research setting, the AILI might be of use in studies in which different methodologies are compared and new methodologies are developed. One might wish to investigate, for instance, whether the finding that self-reports on metacognition and observational measures are usually weakly correlated is equally valid for all components of metacognition. Also one might wish to find out which other methodologies, besides questionnaires, are suitable for measuring the component of ‘metacognitive responsiveness’.

Limitations and suggestions for further research

More research is needed to validate the questionnaire. The results of the comparative study on AILI and MSLQ were encouraging. A valuable next step would be to use the AILI in several educational contexts where powerful metacognition-oriented interventions are undertaken and various measuring instruments are employed to assess effects. Then it could be established for which types of effects the AILI is a suitable instrument. Does it measure self-reported metacognition as a trait that is practically unchangeable or is it sensitive enough to reflect the modest, but stable increases in metacognition, which may be expected from educational interventions? We hope that the AILI...
questionnaire, because of its facet-design, can contribute to tackling the many questions that still remain to be answered in the field of assessing metacognition.

Meanwhile, in addition to the English version, the AILI questionnaire has been translated into French, German, Spanish and Italian. Results of the administrations of the Dutch, English and Italian versions were discussed on an international symposium of the special interest group on metacognition of the European Association for Research on Learning and Instruction (Antonietti 2006; Mason and Nadalon 2006; Meijer et al. 2006; and others). Moreover, Meeus et al. (2008a, 2008b) have published results of evaluations of educational interventions on average AILI scores. Data from the other versions will shed light on the possible international differences between students in higher education that may exist in the domain of learning-related metacognition.

Acknowledgement
This research was financially supported by The Netherlands Organization for Scientific Research.

References


Supplementary material available online

Appendix: The English version of AILI (Version A)

Permission for publication of this questionnaire was obtained from the Netherlands Organisation for Scientific Research (NWO) and the successor to the SCO – Kohnstamm Institute, which is Kohnstamm Institute University of Amsterdam BV.

AILI (A) (E)

Authors: Dr M. Elshout-Mohr, Dr M.M. van Daalen-Kapteijns and Dr J. Meijer. Translation: Dr E.E. Savage.

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Awareness of Independent Learning Inventory: AILI

The AILI is a list of 45 statements. If you indicate how true these statements are for you personally, an image emerges of what you find important in independent studying. There are no right or wrong answers in this list of statements; it’s simply a matter of what is true for you.
Read every statement carefully. Some statements are about your ideas in relation to students in general and some about you yourself as a student. For both types of statements, you should indicate the extent to which the statement is true for you or not. Don’t leave out any questions and try to avoid the answer neutral/don’t know as much as possible. Don’t think too long about your answer; just give your first impression.

P.S. Many statements are phrased in the negative. This makes it more difficult for you to fill in your answer but the nature of our research makes this necessary. NOT like this but like this:

Institution
Programme
Name
Year of entry

1 = not true at all
2 = mostly untrue
3 = more untrue than true
4 = neutral/don’t know
5 = more true than untrue
6 = mostly true
7 = completely true

<p>| | | | | | | | |</p>
<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I know which assignments students really need to work at</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>systematically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I think it’s necessary to make a conscious effort to work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>systematically when you are studying.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>When I’m reading something I don’t pay much attention to whether</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>it comes alive for me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>I don’t think it’s important to feel personally involved in</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>what you are studying.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I ignore feedback from tutors on my method of work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>While working on an assignment I pay attention to whether I am</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>carrying out all parts of it.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>While working on an assignment I keep a record of my learning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>aims.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>When I’ve finished an assignment I don’t check for myself whether</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>I’ve worked at it systematically enough.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I never get the feeling that an assignment has suddenly started</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>to interest me.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>While studying information I never get a sudden feeling that I’m</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>beginning to gain insight.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11</td>
<td>I don’t think it’s necessary to make a conscious effort to gain</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>insight when you are studying.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(continued)
Appendix. (Continued)

12 I wouldn’t know how to enable students to formulate their own learning outcomes.
13 When students find it difficult to gain insight into the material to be studied, I know ways to solve this.
14 Sometimes while working together with others on an assignment I get a sudden feeling that I’m learning a great deal from them.
15 If I find an assignment pointless I try to find out why this is.
16 I think it’s important that there are also personal aims linked to assignments.
17 When I’ve worked together with others on an assignment I don’t think about whether the co-operation was useful for me.
18 I sometimes get a sudden feeling that my method of work doesn’t suit the assignment.
19 Sometimes while working on an assignment I get a sudden feeling that I am learning something valuable from it.
20 When I study information I don’t pay much attention to how well I understand it.
21 When the co-operation between students turns out to be unproductive I don’t know any ways to solve this.
22 When I start on a text I first ask myself what I will need to do in order to study the text thoroughly.
23 I can’t tell whether a text to be studied will appeal to students.
24 When I work together with others I regularly think about what I learn from them.
25 Before I begin on an assignment I don’t have a clear idea of what I want to learn from it.
26 I think that feedback on my personal learning aims is unnecessary.
27 I can’t tell from a text how much effort it will take for students to understand it.
28 I see no reason to talk with others about the usefulness of working together on our studies.
29 When I’ve finished an assignment I don’t consider whether working on it has been useful for me.
30 I think that it’s important that students also learn from each other while they are studying.
31 If my personal involvement in the material to be studied were to be questioned I would think about this.
32 I know various ways in which students can increase their involvement in the material to be studied.
33 Before I begin on an assignment, I don’t ask myself whether I will learn more from it by working together with others.
34 I am interested in why I sometimes get very little out of my co-operation with others.
35 I am not interested in why I have an aversion to some of the texts I have to study.
36 If I can’t bring any structure into an assignment, I try to find out why that is.
37 When students don’t work systematically, I don’t know any ways to solve this.
38 If I find information difficult to understand I don’t try to find a deeper reason for this.

(continued)
<table>
<thead>
<tr>
<th>Appendix. (Continued)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>39 I find it helpful to talk with others about how one can gain an understanding of the texts to be studied.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>40 I can tell whether an assignment corresponds to students’ learning aims.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>41 When I’ve finished studying information I check for myself whether I’ve gone into enough depth.</td>
<td>1</td>
<td>2</td>
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<td>5</td>
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</tr>
<tr>
<td>42 When I’ve studied obligatory material I ask myself whether it aroused my interest.</td>
<td>1</td>
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</tr>
<tr>
<td>43 When I have to study information I try to find out what I will find interesting about it.</td>
<td>1</td>
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<tr>
<td>44 Before I begin an assignment I don’t think about how I will introduce structure into it.</td>
<td>1</td>
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<tr>
<td>45 I know which assignments students will learn more from by working together.</td>
<td>1</td>
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<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>